Mechanic's Magazine

1825.

Vol. 3

PREFACE

TO

VOLUME THE THIRD

It is somewhat difficult to avoid perfect sameness in successive Prefaces to a Work on the same subjects, by the same writers, and addressed to the same readers; but the continued and extended support which the "Mechanics' Magazine" has experienced from both the writing and the reading Public, makes the periodical renewal of our acknowledgments a duty as indispensable as it is grateful.

Although many ages have elapsed since the study of Nature was emancipated from the monopoly and mystification of the schools—since philosophers took the course of penetrating into her mysteries by expe-

riment and observation; and making the real knowledge they acquired available to all the world; there remained, till very recently, another important step to be taken before the benefit of that reformation could be said to be universal. Science had dispensed her sweets among the educated and affluent alone: she had still to visit the dwellings of the unlearned and poor. A solitary attempt to enlarge her sphere of usefulness was made at Glasgow by Dr. BIRKBECK; but his efforts extended not beyond the delivery of lectures to the artisans of that city, and nearly another age was suffered to pass away before either the example of that enlightened individual was generally followed, or that mightier engine, the Press, was called in to assist in the dissemination of a knowledge of principles among the working classes, and in obtaining from them, in return, those benefits which practice has it so much in its power to confer upon theory.

The "Mechanics' Magazine," it was, which first proposed to teach science to mechanics, and invited mechanics to lend their aid to men of science. We chose for our labours an extensive field of original and valuable talent, which had hitherto yielded little or nothing, because neither was that talent properly cherished, nor any means taken of gathering in its fruits when ripe. We addressed ourselves not to bookwise, but to practical men—to those who, the moment that they invent, put their hand to the tool that is to realize, and who are, therefore, the more likely to pursue only what is useful. To use the words of an intelligent Correspondent—"Theory without practice is, as it were, a hidden treasure, unknown to and of no use to

the world; while practice is the same treasure in the hands of the benevolent—

> ——— 'Like the dew, with gradual, silent power,
> 'Felt in the bloom it leaves along the meads.'

And one great advantage to be reasonably expected from such a work as the 'Mechanics' Magazine' was, that it would make practical men of those who before were mere theorists, and give a knowledge of theory to those who were before merely mechanical."

Nor have our hopes been disappointed. Our appeal to the intellectual energy of the Mechanics of Great Britain and Ireland has been answered with so much promptitude and ability, that we may safely assert there is a larger portion of useful matter, from original thinkers, in the three volumes of the "Mechanics' Magazine," now before the public, than is to be found in any other publication of the present times.

We do but justice to our numerous contributors (our own share of the merit is but small) in this assertion of the value of the work. We confess that, without the co-operation of that numerous and most valuable class of our fellow-citizens, to whom we, and the public generally through us, are under so many obligations, the "Mechanics' Magazine" could not have occupied the ground which it does; but, with this powerful and (we are happy to say) increasing co-operation, we hesitate not to say that we have been an instrument in elevating British Mechanics to a rank in the scale of public importance, which, though

they may have always deserved, they have never before attained.

Amongst other things, we have taught them to *combine*, though not for the small purposes which have often (we say not always) marked the combinations of Mechanics, but for that more general and noble purpose—the acquisition of knowledge, and the action and reaction of intellect. It gives us pleasure to think that this good seed, of which we, in our humble way, were among the first (if, indeed, not the very first) to sow, is diffused throughout the country, and springing up with as much strength and vigour as the best friends of the best interests of mankind can desire.

We have the gratification of knowing (and we have our information from the most able and eloquent friend of the Mechanics now living—the distinguished individual whose Portrait adorns our present Volume) that Institutions not nominally mechanical, but composed of real mechanics, controlled by real mechanics, and devoted to subjects of real mechanical utility, are rapidly establishing in every part of the country. "I reckon," says Mr. BROUGHAM, "nearly thirty since my Tract was published, and in every one the principle there laid down, and in which you and I agree, of leaving the management to the men, is recognised by express laws."

Who is there that rejoices not at so delightful a prospect? It is an application of sound philosophy, and not a mere prediction or hope, to say, that the result will be more substantially and more extensively beneficial

than that of any other species of learned or scientific associations, however highly patronized or liberally endowed.

The approbation bestowed on our labours has, happily, not been confined to the class with which we are more immediately connected, nor indeed to any one class of men in the country; for, without any distinction of party—without any allusion to politics—without the least reference to any thing which could divide society, we have received the most flattering testimonies from the very foremost men in station as well as in talent, that the "Mechanics' Magazine" is a Work which has "done the State some service;" and which may yet do much more, if conducted in future (as it is our humble resolution it shall be) in the same spirit by which it has been hitherto distinguished.

Mechanic's Magazine,

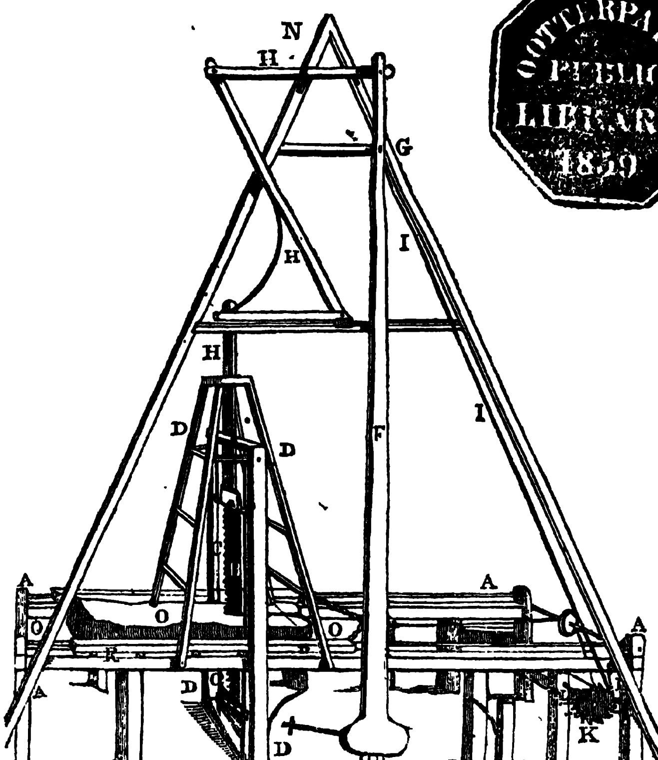
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

"The most valuable gift which the Hand of Science has ever yet offered to the Artisan." *Dr. Birkbeck.*

No. 57.] SATURDAY, SEPTEMBER 25, 1824. [Price 3*d*.

"They helped every one his neighbour, and every one said to his brother, Be of good courage So the carpenter encouraged the goldsmith, and he that smootheth with the hammer him that smote the anvil, saying, It is ready for the soldering; and he fastened it with nails, that it should not be moved."—*Isaiah* xli. 6, 7.

NEW PIT-SAW.



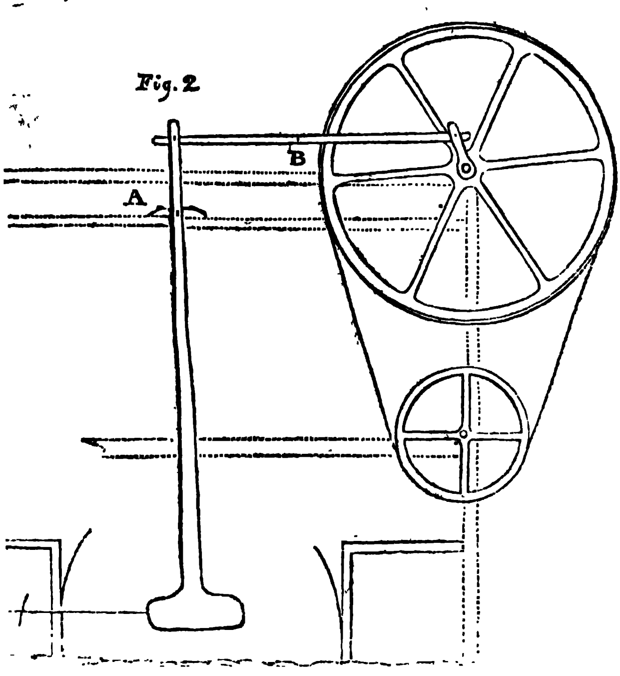
Sir,—You were pleased to insert, some time ago, a description of my new cross-cutting saw. I now lay before you another contrivance of mine, of a pit-saw, for cutting wood into planks and deals, which is wrought by the same power, namely, a pendulum or lever. When the wood to be sawed is fixed on the pit, all that is required is to keep the lever moving between two springs; and one man may do this with ease, with three or

four saws in the frame. I have also shewn how the lever may be applied to other machinery, moving either with belts, chains, or teeth. The length and weight of the lever form its power, and these may be increased according to the power that is required to drive the machine which it may be applied to. I have found by experiment, that a man with a lever, of the proper length and weight, will drive a machine that would require a two-horse power to do it. It is very laborious, in some cases, working at machines by a crank with the hand or foot, and the lever may be applied to such with great advantage.

DIXON VALLANCE, Mechanic.

Liberton, Lanarkshire.

Fig. 2.



Description.

Fig. 1. represents the pit-saw, for cutting wood into planks and deals. A shews the saw-pit; B the saw, which, when put in motion, slides upon two steel rods, CCCC; D D D D is the frame which the saw works in; F the pendulum, or lever; G the fulcrum; H H H the jointed movements which give the motion to the saw; I I a shaft, which is jointed near the fulcrum of the lever, and brings forward the wood to the saw, by turning round a windlass; K a rag-wheel, which is on the end of the windlass, by which the shaft, I I, turns it round; L a spring, to keep the shaft in the teeth of the rag-wheel; M a catch, O the wood fixed on the frame moving forward on rollers; R the rollers; N the frame that the lever is fixed in, with its jointed movements. The length of the lever may be twelve or fifteen feet.

Fig. 2. represents the lever applied to machinery; A is the fulcrum of the lever; B the shaft which gives motion to the wheel; the lever moves between two springs, which makes its motion more easy.

NEW MODE OF FULLING CLOTH.

Messrs. Northrup and Dillon, of New Jersey, North America, have proposed a method of fulling cloth without employing soap or any other alkaline matter, and without steam, in a much shorter time, and in a

more perfect manner, than has been heretofore accomplished; their process is described as follows:

"After the oil has been removed from the cloth, it is to be dried. A composition is then made of rye flour and pure water, in the proportion of four quarts of the flour to eight gallons of water, which is to be boiled to the consistency of a thin paste, or the flour may be mixed in hot water. The cloth is then to be made sufficiently wet with the paste (which may be applied either warm or cold), and put into the same kind of fulling mills, and beat about, as is customary when soap or steam is used. When the cloth has been sufficiently fulled in this manner, the paste is to be washed out or scoured with pure water.

"In the same manner a thin paste, made of wheat oats or barley flour, may be employed, and other vegetable substances of a similar nature may be used in the process of fulling with great advantage: the employment of vegetable matters, instead of animal matter, in the process of fulling, being the substance of the invention.

"By using these materials, the cloth becomes fulled to a proper thickness in a much shorter time than with soap; is softer, firmer, and less worn in the mill; costs (in America) one-fifth the expense of fulling with soap, and retains the colour of indigo blues, and all other colours that are dyed before fulling, in greater perfection than when soap is employed."

IDEA OF AN AIR ENGINE.

Sir,---I have long entertained an idea, that an engine might be so contrived, that it could be worked by a succession of powerful explosions of condensed air through a valve, on the principle of the air-gun; but I have given the subject more attention since steam-engines were applied to propel vessels at sea, and since the distressing accidents that have occurred by the use of fire. In the ardent hope, however, that the following (I admit) crude suggestion may meet the eye, and attract the attention, of some person *qualified* to entertain the subject, I shall proceed to detail my ideas.

On the mere supposition that a force is required equal to the power of steam, to rapidly raise the lever of the engine, I propose, that immediately under the piston of an engine there should be placed a large cylinder, capable of containing a sufficient quantity of condensed atmospheric air; over the valve of which cylinder the piston should closely enter to a proper depth, and be ready, on the action of a spring or trigger, to receive the whole force of the explosion, and thus violently force up the lever in the same proportion of power as is now done by steam. With a view to check the sudden shock the engine would thus receive, an arm-spring of sufficient power might be applied to command the piston *inside*, and at the top of the cylinder. Another explosion from the chamber of condensed air would bring down the piston with equal force. With the view to keep this chamber (containing the condensed air) constantly charged to the very highest pressure, whereby an equally effective discharge could be made each moment, I propose that an air-pump should be attached to the engine, which could be worked by the common motion of the lever; or that a man should turn a wheel, which, by being connected with other wheels, springs, and proper machinery, the valve of the air-cylinder would be opened, and the air therein brought to act against the extremity of the piston, which would thus be forced up with extreme violence, thus raising the lever; in a second of time, the air-pump could then force in as much as had escaped in the first discharge or explosion, and then, in equal and due time, the piston would be ready to receive a second explosion, of precisely the same power as the former, to bring it down. Thus, by a well-regulated and scientific movement, in rapid succession of powerful discharges of condensed atmospheric air, a force could be brought to act up and down fully equal to steam.

As the air-pumps would be by this constant work rendered very hot, which would heat the cylinder or air-chamber so much, that thereby the air might be dangerously rarefied, I propose that the pumps should be

encircled or enclosed in a case with a sufficient quantity of cold water, and which, by a simple contrivance, in a certain number of turnings of the wheel (equal to five minutes' time), could be let off, and a fresh supply of cold water made to rush in from a reservoir above, to supply the place of the water heated by the barrel and action of the air-pumps. This cold water, so often repeated, or made to be constantly running off, would serve to condense the air in the cylinder, and enable it to receive a greater quantity than it otherwise would.

If it should be considered that one cylinder would be insufficient to force the piston up, and then down, there might be two cylinders, one to force it up, and the other to force it down; and if so, then the air-pump could be filling the one during the expulsion of a part of the air in the other; thus both would be kept alternately working. Each chamber might be capable of containing, upon the principle of the air-gun, as much air as would hold fifty discharges; *one only* of which discharges would be let off against the piston, on which the air-pump would instantly after force in a fresh supply of air to the very highest pressure; *thus every discharge would be of equal force.* The man who turns the wheel could have his movements regulated by a given scale, or pendulum; and it is not improbable that, in places where the engine could be placed in a fixed and steady position, the whole machinery could be worked (provided the air-chamber was previously charged) by a powerful clock and multiplied wheel movement, with heavy weights and maintaining power, which could be wound up every twenty-four hours; or after the attendant had let off the first explosion, the machinery could be so arranged, that, by the turning of a wheel, every succeeding explosion could be let off by the action of the engine itself on the trigger attached to the cylinder.

It is almost needless to observe, that if something like this plan could be carried into effect, the great expense of fuel would be saved, and safety ensured from fire.

If you, Sir, shall think this suggestion worthy of a page or two in your useful Magazine, you will greatly oblige me by inserting it.

I have the honour to be, Sir, your most obedient servant, W. H. C.

ON THE PROPERTY OF ANIMAL CHARCOAL TO PREVENT THE CORRUPTION OF WATER; BY A. CHEVALLIER.

Having been consulted by M. B. on the means of preventing the water of a pond in his garden from becoming offensive, I suggested the use of Animal Charcoal, and begged him to let me know the result of the experiment. A letter addressed to me on the 15th of November last, assures me that the experiment has succeeded perfectly. The following is an extract of the letter:

"There is a pond, of nine feet in diameter and three feet deep, in the garden of M. B., the water of which is used for watering the garden. The pond is filled with water from a well; but, on the approach of autumn, it becomes offensive, and a mephitic odour arises from it.

"When it was annually cleaned out (an operation for which buckets were found necessary), there was found in the bottom a putrid slime, which rendered this work very disagreeable, and *perhaps dangerous.*

"This year, on the 10th August, 1823, M. B. had 45 lbs. of animal charcoal, in powder, thrown into the pond; being careful to have it spread equally, by means of a basket of open wicker-work carried over the surface of the water: the powder which floated was soon precipated to the bottom.

"This water was used for watering, and partly renewed as it became necessary. The waterings ceased about the middle of September. The water, which was then 20 inches deep, was left undisturbed, and has not been since changed; and although it is discoloured and even greenish, it is entirely inodorous—*thanks to the animal charcoal.*"

M. B. having sent me a bottle of the water, I observed, on examining it, that it had neither a disagreeable smell nor taste; and that, during the eight days which have elapsed since its removal from its carbonaceous bed,

it has not undergone any change, and shows no signs of corruption

The animal charcoal which has been thrown into the pond may, when taken out, be used as a manure; and this manure, which, by slow degrees, imparts to vegetables the substances which it has absolved, is one of those which merit a most attentive examination.

THE ART OF TURNING.

SIR,---Amongst the various works that treat on practical mechanics, I have often felt surprised that so few have been given to the public on Turning, which is not only an extremely useful, but highly ornamental art. For though, of late years, many gentlemen have turned their thoughts to this subject, they have not condescended to publish to the mechanical world the fruits of their labours, and to treat the subject in that scientific manner which it demands: indeed, the only work that seems at all calculated for the practical mechanic in the higher department of the art, is one that is but very little known, but which deserves more consideration than it has hitherto met with---I allude to a publication, which came by mere chance into my hands very lately, entitled, "Specimens of Eccentric Circular Turning, with practical Instructions for producing corresponding Pieces in that Art," by Mr. Ibbetson. It is a work extremely well calculated to direct the workman how to execute those embellishments so often pointed out to his imitation in remarkable specimens of turnery, but which, unfortunately for the mere workman, are but little known, partly owing to the very expensive apparatus thought requisite, and partly to the want of a familiar explanation of the manner by which the various combinations of eccentric and concentric circles may be produced. I will venture to affirm, and, indeed, know by practical experience, that those expensive and highly finished engines are not absolutely necessary to the practical workman, whose object, in the tools he uses, is not elegance, but utility. Some time since, I constructed a rude lathe, that would perform all the different processes of elliptic and eccentric turning, at an expense not exceeding that of a common lathe, such as is sold at any of the tool-makers in town; and hence I am induced to believe, that the ingenious mechanic, were he aware of the methods used in the higher branches of the art, would find no difficulty in adding to any common lathe the necessary apparatus.

The work before me, of Mr. Ibbetson, furnishes precisely the information that is required; and the perusal of it, I am sure, will amply repay, not only the amateur, but the workman, and furnish hints for the formation of almost any eccentric figure wished to be produced. There is much to be admired in the beauty and accuracy of the illustrative plates, but much more in the very clear method pointed out to the workman to produce their counterparts. As the work itself contains so many practical problems, it may not, perhaps, be uninteresting to many of your correspondents if some notice is taken of them, and the various purposes to which this part of the art may be applied.

Our author gives six specimens of eccentric circular turning, in the like number of beautiful plates, which are all varied in such a manner, that every one of itself contains some new application of the tool and chuck used, and the whole together forms a series of examples, whereby the artist may form an infinity of various beautiful ornaments. An account of two or three of the specimens will give an idea of the whole. Plate 2. exhibits a specimen ornamented with an Etruscan border, produced by a multitude of small circles, arranged in the form known, particularly amongst cabinet-makers, by the title of the *à-la-Grecque* border, and appears at a little distance from the eye like a broad line. In the centre of plate 4. is a star with circular radii, formed by portions only of circles eccentric to each other. Plate 5. is a specimen of that ornament which is so frequently seen in watch-cases, and has somewhat the appearance of a wheel with circular spokes, or radii, diverging from the centre. Indeed,

the whole of the specimens form a series of beautiful ornamental engraving, that may be applied with advantage to a variety of useful purposes, such as the embellishment of watches, snuff-boxes, trinkets, &c. It will also be highly useful to the engraver, to form borders, &c. to cards and cheque plates. The examples, moreover, are so selected, that they can be adopted either in part or as a whole.

If this notice of a work deserving of perusal should be the means of raising an emulation amongst our working turners to improve their art, and raise it above what it has too long been, rather as a secondary branch of mechanics, I shall feel happy to have rescued from mediocrity a class of workmen, that, I am sure, want only encouragement to raise their art to a level with others, to which it has hitherto but lent its aid.

If you think some drawings of the various chucks and tools used in the art of turning, would contribute to the advancement of an art of which I am a great admirer, I may, at some future period, send some, with practical illustrations of their several uses.*

I am, Sir, yours, &c. G. A. S.

* We shall be happy to receive and give them a place.

AMERICAN INVENTIONS AND IMPROVEMENTS.

A Mr. Alfred Churchill, of Batavia, United States, has invented a new Screw, which is thus spoken of in the American papers: "The screw is concave, and meshes, with admirable regularity, with the cogs placed in a circular wheel, which is moved with ease and rapidity, with the application of small power. To show its immense strength, it is only necessary to mention that the thread of the screw, in its evolution, presses at all times upon four of the cogs of a wheel containing eleven cogs, and may be so constructed, if necessary, as to encircle five-elevenths of a circle."

The same Mr. Churchill is said to have invented a new and ingenious hydraulic model; "its power for raising whatever bids fair to excel any preceding principle, where the height required should not exceed the half of the diameter of the wheel used in lifting and discharging the water."

Another machinist, called Salstonhall, of New York, pretends that he has discovered a new Wheel, adapted to all mechanical purposes, but more particularly to time-pieces, the powers of which exceed all belief. It is said to be "founded on the motions of the solar system," and to be "capable of taking any power, and to any extent;" its cause is "self-existing," and it can not only "set itself in motion," but "cause inanimate nature to revolve of itself;" and, finally, it "will keep *a continued circular perpetual motion!!*" Who can doubt that this is all a chimera? The *inventor* refers to the principle of the invention as "*recorded in the Patent Office of the United States;*" but we do not find that any of the scientific Journals of America have yet thought it worth the trouble of mentioning.

"We have examined," says the *Massachusett's Spy*, "a sample of leather tanned in a new mode, by Capt. Charles Munroe, of Northborough, in this country, which is pronounced by competent judges to be of the first quality. The sample is calf-skin, and was tanned in ten days. By this process the expense is somewhat reduced, and the capital employed may be turned much oftener than in the old way. Sole leather may be tanned three times, upper leather six times, and calfskins nine times in a year, in regular business, with no danger of failure or injury to the leather. The liquor for tanning is used cold."

BROWN'S GAS ENGINE.

A Company, upon a large scale, has been formed in the City, for the purpose of applying Mr. Brown's Gas Engine to the propelling of wheel carriages. The capital is two hundred thousand pounds, in shares of ten pounds each, of which ten per cent. is to be deposited in advance, and no more will be required until the pro-

'ectors shall have driven a carriage from London to York, and back again, at the rate of ten miles an hour. All the shares are already subscribed for, and they expect to be enabled to start their first carriage in about two months after this date.

We still look upon Mr. Brown's invention as one of the first discoveries of the age in which we live, and we have not the slightest doubt of the successs of the experiment. The power applied is so portable, that a man of ordinary strength may carry an engine of two-horse power upon his back; and the quantity of power, therefore, to give velocity, need only be limited by the necessity of studying the safety of the passengers and the public at large. If it is found that a carriage can travel, without danger, at the rate of twenty miles an hour, the necessary power can be applied quite as easily as if it were only required to propel it at the rate of ten.

IMPROVEMENTS OF LONDON.

SIR,---In one of your late Numbers, a Correspondent, who signed himself "Julius," has given an outline of a plan for rebuilding London after the great fire, by Sir Christopher Wren. The idea appears to have been a magnificent one, and worthy of the genius that proposed it; and it is much to be regretted that the opportunity was lost, perhaps for ever, of carrying it into complete effect. I remember to have once met with a book published by a Mr. Gwynne, and dedicated to his Majesty, somewhere about the commencement of his reign; being a "Plan for the Improvement of London and Westminster;" and which, from the recollection I have of it, must have furnished hints for many of the improvements since made, and some of which are now in progress. The improvement of such a metropolis as London, which may now, without the imputation of national vanity, be considered the emporium of the world---the centre of commerce, arts, and elegances---is surely an object highly deserving the attention of Government. And if only the sum of three or four millions were devoted to that object, in the progress of the next five-and-twenty years, in carrying into effect some well-adapted and elegant plan for improving the metropolis generally; it would surely be well laid out, and an expenditure which the most rigid economist of the public money would not grudge, if so applied. The Athenians, I believe, dedicated a tenth of the spoils of war to the embellishment of their city; by which they made it the wonder of the world, and the resort of the wealthy and curious of all nations, whose expenditure would doubtless make an ample return to the inhabitants of that superb city for the cost of its embellishment. Our Government hitherto unfortunately have managed things differently; but let us hope that it is not too late to expect of them some attention to this truly national object; and that they will, by their example, give an impulse to the national taste, which shall extend itself all over the country. Then may we expect, in another century, if the prosperity of the country continue, that our children's children will see London another Athens, in elegance of arrangement and splendour of decoration, with a tenfold increase of magnitude. Should any of your correspondents possess the book alluded to, and will favour the public with an outline of Gwynne's plan, it cannot fail of being acceptable. It will show how far it has been acted upon in our day, and will prove, that however long suggestions of this nature may lie dormant, in the end it is not labour spent in vain to point out the means of judicious national improvements; and that though the projector may have the mortification to see his plans neglected and apparently forgotten, time and circumstances may at least combine to bring them into notice, and ensure their being carried into effect.

J. N.

CHEAP PROCESS FOR MAKING THE SCHWEINFURT GREEN DYE.

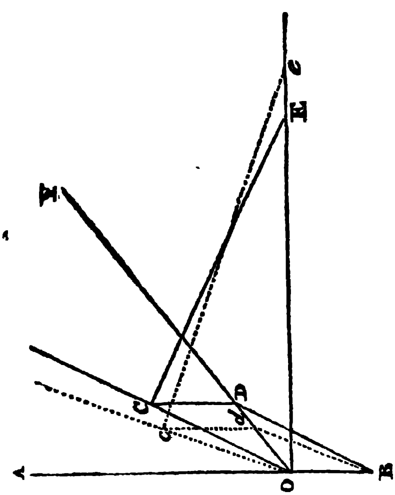
The Schweinfurt Green Dye, which has recently acquired great reputation on the Continent, has been analysed by two chemists, M. Braconnot and

Dr. Liebig, who have not only discovered its constituent elements, but pointed out how it may be compounded The process of Dr. Liebig, which seems the simplest, we extract from the "Annales de Chimie."

"Dissolve, in a copper kettle, by heat, *one* part of verdigris, in a sufficient quantity of pure vinegar, and add to it an aqueous solution of one part of white arsenic. A precipitate of dirty green generally forms, which must be renewed by adding more vinegar, or till the precipitate is perfectly dissolved. After boiling this mixture, a granular precipitate will, in a short time, form, of the most beautiful green colour, which, being separated from the liquid, and well washed and dried, is the required colour. If the liquor, after this, contains copper, more arsenic may be added; and if it contains an excess of arsenic, more copper may be added, and the process repeated. When the liquid contains an excess of acetic acid, it may be employed in dissolving more verdigris.

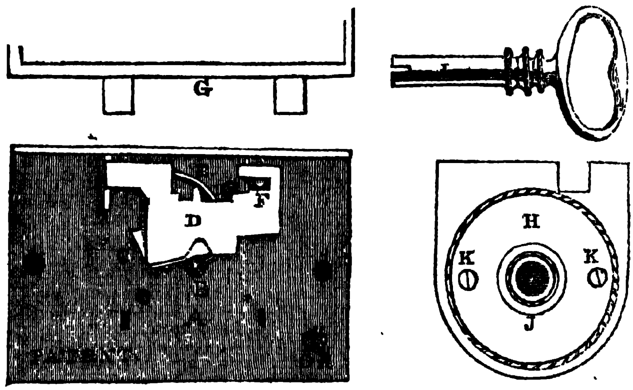
"The green prepared in this way has a bluish shade; but the arts often require a deeper shade, somewhat yellowish, but of the same beauty and elegance. To produce this, dissolve a pound of common potash in a sufficient quantity of water, and having added to it ten pounds of the colour prepared as above, warm the whole over a moderate fire. The mass will soon acquire the required shade. If it is boiled too long, the colour will approach to Scheele's green; but it always surpasses it in beauty and splendour."

GEOMETRICAL EXERCISE.



Let O Y be any fixed line drawn within the right angle A O X from the vertex O, and B be any fixed point in A O produced. From O let any line O C be drawn within the angle A O Y, and to it a parallel B D through B, meeting O Y in D. Complete the parallelogram B C, and from C draw C E perpendicular to O C and meeting O X in E. Then it is required to prove that the point E is nearest O, when O C bisects the angle A O Y; that is, supposing O C in the figure to bisect A O Y accurately, and O *c* to be determined similarly with O E, but from a line O *c*, which divides the angle A O Y into unequal parts, it is required to prove that O E is less than O *c*.

ELLINGTON'S PATENT LOCK.



SIR,---I take the liberty of submitting, for your inspection, a Lock (for which I have obtained a patent), which, in itself, I may say (with the greatest mechanics who have seen it), is the most secure and simple now in use.

Description of the Lock.

A is the brass plate of the lock.

B the pin which goes into the pipe of the key, having at the lower part a circular piece of brass, which revolves round it; this has four slits to receive the corresponding parts of the key.q

C the tumbler.

E the spring to keep down the bolt.

F the pin to secure the bolt in its place.

G the staple (double link).

H the cap.

I the key.

K K the screw-holes of cap.

J the bush, or pipe.

The advantages of this lock will be obvious from the description. Instead of a great heavy key, with a large bit of iron (called a bit), being required, as in locks of the kind now in vogue, you have a key so small, that it may be attached to the watch-chain; nor is there any possibility of the bit breaking in the lock, as is sometimes the case, and valuable articles of furniture being thus destroyed or damaged.

In the next place, there are no wards to break or bend; the brass circular revolving talent answers the place of the wards, shooting the bolt as it goes round. The slits answer the purpose of keeping out any false pipe, or skeleton-key, which might be introduced. The cap of the lock is made with a large bush, similar to Mr. Bramah's patent, so as to leave no possibility of a picker entering.

The price of Mr. Bramah's lock is 8s. 6d.; but the utmost which can, with propriety, be charged for mine, is only 1s. 6d.; while it is equally, if not more, secure. Any of my make I will warrant beyond all possibility of being picked.---I remain yours, very respectfully,

SAM. ELLINGTON.

Wolverhampton, July 24, 1824.

INUTILITY OF THUNDER-RODS.

The utility of Thunder-Rods has for many years, been an universally admitted fact among philosophers; so much so, that one of the most celebrated scientific controversies in England turned on the important question, whether, in order to make the most of them, they should be terminated by *points* or by *knobs?*

The powder magazine at Purfleet, though guarded by pointed conductors, happening, in 1778, to be struck by lightning, the Privy Council made an application to the Royal Society to investigate the cause of this accident. A committee was accordingly named of its ablest members, who, still adhering to the hypothesis of

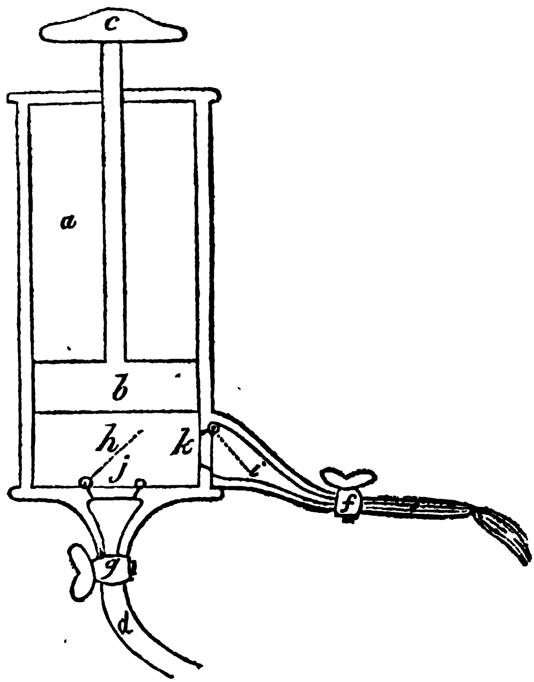
Franklin, only recommended additional pointed conductors to be placed at nearer intervals. This report, in the height of the revolutionary war, could not be otherwise than displeasing to the courtiers, who, from their violent antipathy to the American philosopher, were as eager to depreciate his science as to deride his patriotism. They accordingly set on foot a subscription to enable Mr. Wilson (father of Sir Robert Wilson) to perform electrical experiments on a large scale in the Pantheon, and the conclusions thence drawn seemed favourable to the theory of knobs. The Royal Society was, in consequence, *desired* by high authority to revise their Report; but the President, Sir John Pringle, replied with some warmth, that *he could not change the laws of nature!* Soon after, the worthy President was given to understand, that, *since he could not do that,* he had better resign; and he was, in fact, so worried on all sides, on account of his scientific integrity in this matter, that he was driven from the Chair in disgust.

Such sticklers for points and knobs would have looked amazed to be told, as we now are, by a person of no less authority than Professor Leslie, that rods of any kind are nearly altogether useless. The Professor, in a paper which he has written on the subject, in the *Edinburgh Philosophical Journal,* lays it down as a principle not to be disputed, that electricity is never communicated in any perceptible degree to a remote and unconnected body, but by means of a current of air; and, assuming this to be the fact, he thus proceeds to refute the supposed efficacy of lightning conductors: —

The air, which streams in all directions from the cloud, is dissipated among the more remote portions, and thus gradually communicates its electricity. Hence, from the wide dispersion, owing to the distance, the electricity of the air at the surface of the earth must be weak; and, even in the midst of the storm, the electrometer is less affected than if placed only a yard behind the prime conductor. Yet the action of the thunder-rod is confined entirely to the air which immediately surrounds it, and the quantity of aërial current which it can produce must evidently be inferior to what is directed to the point, when held several feet from the conductor of an electrical machine. But to avert the stroke, it would be necessary that the whole air between the surface and the cloud should be brought successively in contact with the top of the rod. Nor is this all; for the air will be constantly replaced by other electrified portions emitted from the cloud. The effect of the thunder-rod is, therefore, comparatively, but a drop in the ocean.* It may be easily shown, that, however pointed and tapered, it would require a thousand years to guard at the distance of a hundred yards; if terminated with a knob, it might take ten thousand years. Such are the vaunted performances of thunder-rods, and such the advantages of their different forms! Nor can we appeal to experience; it never can be proved that thunder-rods have produced beneficial effects, but several instances may be cited where they have afforded no sort of protection. Nay, we shall be convinced, that fully an equal proportion of the buildings armed with such supposed safeguards have been struck with lightning. But if thunder-rods are useless, they are also innocent; and that they provoke the shaft of heaven, is the suggestion of superstition rather than of science. The cloud exerts an attraction, indeed, upon the surface of the ground, but the force depends solely on the distance, and is not, in the least degree, affected by the shape or quality of the substances below. It rolls towards the nearest and most elevated objects, and strikes indiscriminately a rock, a tree, or a spire.

* It appears, from the experiment with the heated ball, (an experiment to prove that, by means of heat, a ball may be made an equally good conductor with a point,) *that a good kitchen fire has more efficacy in preventing a house from being struck,* than a whole magazine of thunder-rods. Hence one of the reasons why a thunder-cloud diminishes so fast in passing over a large city.

IMPROVEMENT OF JUKES' POISON-EXTRACTING PUMP



Passing through the Strand, a few days ago, I saw, in a surgeons' instrument maker's window, the newly invented Pump for extracting Poisons from the stomach. The principle of it is admirable, though, like most new inventions, it is, I think, susceptible of improvement.

In the one I saw, the communication between the pipe leading to the stomach and what I shall call the ejectment pipe, with the body of the syringe, is cut off alternately by means of *two* cocks. Now, unless the syringe is worked by at least two persons, this must cause a great inconvenience to the patient from the time the pipe remains in the stomach; but, by employing two small valves instead of the cocks, it might easily be managed by one person only, and the time lost in opening the cocks saved. The following is a short description of the instrument, with the manner in which I propose that the valves should be placed:

a is the cylinder.

b the sucker.

c the handle.

d the flexible pipe leading to the stomach.

e the ejectment pipe.

f and *g* the two cocks as used at present.

j and *k* the two valves, with hinges, to allow them to move to the dotted lines, *h*, *i*, and there stop them.

From the above sketch it will easily be seen that, in raising the sucker, it will open the valve *j*, and at the same time keep the valve, *k*, firm in its place, and that, in pressing it downwards, the contrary will be the case; by which means the trouble with the cocks will be avoided.

Perry-street, St. Pancras. F. H.

P. S. I conceive this instrument might also be advantageouly employed in the recovery of persons apparently drowned.

DISCOLORATION OF CORAL ORNAMENTS.

It has long been known, that necklaces, bracelets, and earrings of Coral, undergo, after being worn, a very remarkable change, and become extremely white and porous. Jewellers have no other remedy for this deterioration, than to remove the upper stratum of coral, till they come to a depth where no alteration has been produced.

This change had been ascribed to the action of air and of light; but this was found by experiment not to have been the case: and a discoloration never took place, unless when the coral had actually been worn as an ornament; in which case it has sometimes been completely whitened, when used only two or three times upon the naked skin, and in heated apartments. A M. Virey, who writes in the "Journal de Pharmacie," ascribes the discoloration and porosity of the coral to the action of a particular acid which exists in the moisture of the body. According to the analysis of Thenard, the acetic; according to Berzelius, the lactic; and according to Berthollet, the phosphoric—acid is found in it, under particular circumstances.

In order to prevent this deterioration of coral, when used for the purposes of jewellery, M. Virey remarks, that it will be sufficient to impregnate it with a fat body, which will defend it from the immediate action of weak acids; and, for this purpose, he recommends that the coral should be digested in warm oil, or melted wax, so as to enable it to resist the action of the acid to which it is exposed.

SELF-MOVING CARRIAGE.

Mr. D. M'Donald, of Sunderland, informs us, that he has invented a "Self-moving Machine" for travelling on roads, which has carried seven persons. "It is propelled by means of treddles: a man sits behind working the same, and there is a fly-wheel operating upon two cog-wheels, which operate upon a square axle. You will, perhaps, think the man behind has hard labour—not so: from the velocity of the fly-wheel, together with the aid of a lever, which is in the hand of a person in front steering, he has not often to put his feet to the treddles." Mr. M'Donald intends, when he shall have improved the friction of the body of the carriage, to present the same to the Society of Arts; and, as he desires to receive no emolument for the same, he hopes it will come into general use.

PLAN OF A STOVE FOR PAPER AND WOOLLEN-CLOTH MANUFACTURERS, &c.

It is proposed that the stove shall be of cast metal, with a chimney of the same material continued up to the level of the top of the drying-room, and that the stove shall have a fire-door and close-door for the ash-pit, and an aperture into the ash-pit from a descending flue, brought from the top of the drying-room, and provided with a slide or regulator in it. Let such a stove be placed within an air-chamber, built at the outside of the drying-room, the base of which must be on or below the level of the floor of the drying-room, and extended to its height, four feet in diameter, inside measure, and to be there contracted to a suitable size for a chimney, and then continued to any desirable height. A space must be left open at the base of the air-chamber, of the size of the fire and ash-pit doors, to supply the stove with fuel from the outside.

On the side of the air-chamber let there be a descending flue of brick-work, connected at the top and brought down to the floor of the drying-room, and there communicating with a horizontal brick flue, which should run along the centre of the room with branch flues on both sides, provided with regulators in all directions, for admitting warm air into all parts of the room.

The air-chamber has an opening, 18 inches square at the bottom, below the level of the stove, for admitting the air from the outside, which, by coming in contact with the stove and its chimney, will become rarefied, and heated.

The stove is supplied with air, for the consumption of the fire, through its descending flue from the top of the drying-room, when its regulator is open; for, by the stove-chimney extending, say 10 or 15 feet above the height of the descending flue, the fire will have the effect of causing the steam and rarefied air to descend down that flue, acting on the principle of a syphon, when all other communication to the stove is cut off, which air must be replaced by a supply of air into the drying-room, and (the door and windows being perfectly close) can only be had through the regulators in the warm-air flues from the air-chamber; thus producing a constant and regular supply of warm air throughout the drying-rooms. When the slide or regu in the descending flue, conn lator with the stove, is closed, the fir ected go out, so that no more fuel we will consumed than circumstances r ill be

Yours, respectfully, equire.

Newcastle-on-Tyne. W. H.

SHORT RULES FOR CALCULATING THE PRICE OF TIMBER.

To compute the value of deals, the price per hundred being ascertained.

RULE.--Double the price in pounds per hundred, and call the product pence, which is the value of one deal.

EXAMPLE.---Deals cost 36*l.* 10*s.* per hundred, what is the value of one deal?

36*l.* 10*s.*
2

The value of one deal in pence . . . } 73*l.* 0*s.* or 6*s.* 1*d.*

To compute the value of deals per hundred, when the value of one is ascertained.

RULE.---Reduce the price of one deal to pence, call the product pounds, and divide by 2.

EXAMPLE ---A deal cost 6*s.* 1*d.*, at what rate is that per hundred?

6*s.* 1*d.*
12

2) 73*d.*, to be called pounds,

One-half of which, or } 36*l.* 10*s.* price per hundred.

A PERMANENT BUFF OR NANKEEN DYE, FOR MUSLIN, LINEN, COTTON, AND, PROBABLY, SILK OR WOOLLEN, FROM HORSE CHESNUTS.

For the buff colour, take the whole fruit, husk and all, when quite young (perhaps about as large as a small cherry); cut it small, and put it into cold soft water, with as much soap as will just cloud or discolour the water. When deep enough, pour off the clear part, and dip whatever is to be dyed, till it is the colour required.

For the Nankeen colour, take the *husks* of the fruit only; cut or break them small; steep them in soft water, with soap as above, and dye in the same manner. The *husks* may be used for the buff dye, after the kernels are formed; but it is only when they are almost imperceptible that the whole fruit is used, and the brightness of the buff colour diminishes as the husk ripens, till, when quite ripe, the dye is most like nankeen.

It is thought that this, which was discovered by accident many years ago, is not generally known; and that being a permanent, cheap, and easily procured dye, it may be useful, and supersede, in some measure, foreign dyeing stuff. The soap used was white or brown Windsor, and common mottled, whichever was at hand. Hot water seemed not to answer so well as cold in making the dye, as it was less bright; but once dyed, nothing ever was found to efface the colour. A dyer would easily find the proportions, and, perhaps, some alkali, instead of that of the soap. But if tried *at all*, it is *particularly requested* that the directions here given may be *strictly followed* at *first*, as they are *exactly given* by the person who is thought to have made the discovery. Muslin, linen, cambric muslin, and calico, were tried: it did not discharge the colours of printed cottons.

The husks may still be gathered during this month and most of October. Whether any use can be made of them when dry, or whether the dye can be made and kept till the young chesnuts are ready, has not been ascertained.

PROGRESS OF ART.

The difference between a nation with and without the arts may be conceived, by the difference between a keel-boat and a steam-boat combating the rapid torrent of the Missisippi. How slowly does the former ascend, *hugging* the sinuosities of the shore, pushed on by her hardy and exposed crew, now throwing themselves in vigorous concert on their oars, and then seizing the pendent boughs of overhanging trees! she seems hardly to move; and her scanty cargo is scarcely worth the transportation! With what ease is she not passed by the steam-boat, laden with the riches of all quarters of the world, with a crowd of gay, cheerful, and protected passengers, now dashing into the midst of the current, or gliding through the eddies near the shore! Nature herself seems to survey with astonishment the passing wonder, and, in silent submission, reluctantly to own the magnificent triumphs, in her own vast dominion, of Fulton's immortal genius!—*Mr. Clay.*

GUNTER'S LINE.

Sir—Your Correspondent, "Unit," (p. 364), inquires, "where are 32 and 16?" Let him open the sector, and lay it before him, with that line uppermost, marked N, on the right. In the line marked N find the first 8 from the left, the which, to be readily found, is exactly 4 inches and ½ from the left extremity of the sector, or 1 inch and a half from the opening of the sector towards the left extremity. The 8 being found, the next figure towards the right is a 9, and the next a 1; but the 1, in the example before us, must be called 10; the next a 2, which must be called 20; the 3 must be called 30; and the 4 must be called 40; and so on till the 10 at the end must be called 100. But now let him look back to the second 1, which I before said must be called 10; "Unit" will find the space between the second 1 (10) and the second 2 (20) divided into 10 parts. I may here remark, that 6 parts of the 10 are on the left half of the sector, and the 4 parts on the right half of the sector; the parts being divided by the opening of the sector. "Unit" may now refer to the 1 next to the 9, which one is to be called 10; the first subdivision must be called 11, the second subdivision to be called 12, the third subdivision to be called 13, the fourth subdivision to be called 14, the fifth subddivision (which is easily distinguished by its being made twice as high as the other subdivisions) to be called 15; the sixth on opening of the sector, to be called 16 ("Unit" has now found the required 16); the seventh subdivision to be called 17; the eighth subdivision to be called 18; the ninth subdivision to be called 19; and the 2 to be called 20. But there are also 10 subdivisions between the 2, at which we have arrived, and the 3, which will make the 3 to be called 30, as before. There are also 10 subdivisions between the 3 (30) and the 4 (40); but 40 exceeds the number in "Unit's" data, his number being 32; let him then take *two* only of the subdivisions, on the right of the 3, which is 30, and the two subdivisions will be called 32; 16 being at the opening of the sector. That "Unit" may not possibly mistake the 16, it is exactly 6 inches from either end of the sector, (I have presumed his sector to be 12 inches in length), and the 32, 4 inches and a half from the right extremity towards the opening of the sector, or it is 1 inch and a half from the opening of the sector towards the right extremity of the sector. If "Unit" places one foot of the compasses at 8, (having previously taken the extent of 3* inches in the compasses), that extent will reach to two subdivisions past the 3 (30), which two subdivisions will make 32; let him bisect that extent, and the half extent will be equal to 1 inch and a half: that extent, when applied forward from the 8, will point out the opening of the sector, which is 6 subdivisions past the 1,

* The reason I mention 3 inches is, because I found the extent from the place of 8 to the place of 32 corresponds exactly with 3 inches in length.

which is called 10, making together 16; and if applied backwards, with one foot of the compasses placed on the second subdivision past the 3 (30), it will point out the opening of the sector (16) as before. Let "Unit" try the mean proportional of 12 and 48, thus: place 1 foot of the compasses on the 2d subdivision on the right side of the 1, which in the last example was (as in this) called 10, and extend till the other leg reaches to 8 subdivisions on the right of the 4 (40), which is the place of 48; bisect that extent, and the half extent, with one foot on the second subdivision on the right of the 1 (10), the place of 12, will reach to four subdivisions on the right of the 2 (20), which is the place of 24, the mean sought; or, if applied backwards, one foot must be placed on the eighth subdivision, on the right of the 4 (40); it will point out four subdivisions on the right of the 2 (20), as before, making 24 the mean sought.

I hope I may be excused for this long article; but I was afraid your Correspondent, "Monad," in his answer, was not so explicit on the subject as "Unit" required. I am, yours, &c. W. PICKETT.

Ratcliff, Sept. 10, 1824.

P.S. Dollond, in St. Paul's Churchyard, will supply "Unit" with a pamphlet on the subject for sixpence.

ANSWERS TO QUERIES.

QUODLIBET'S PROBLEM.

SIR,---Looking at your last Number, I find a Correspondent answering a query, which I assume to have been this:---Suppose a square divided into any number of equal parts, and one quarter of these parts being taken away, how shall the remaining three-quarters of the square be divided into five equal and similar parts? Your Correspondent gives one answer---I shall give another: thus---Let the square be divided into 60 parts, by drawing two lines through it one way, and nineteen the other. The fifth line will bound the one-quarter of the whole, and every third line will bound one-fifth part of the remaining three-quarters, and the five pieces will evidently be similar. To divide three-quarters of the square into any number of similar pieces at pleasure, if the number be *odd*, draw *two*---if *even*, *one* line through the square in one direction, and one line less than the number of similar pieces it is proposed to make, and one-third of that number more in the other direction. If a fraction occur, you must get rid of it, as follows:

EXAMPLE.—In the above query, the number of similar pieces being odd, draw two lines one way, $5 + \frac{5}{3} = 6\frac{2}{3}$, and, to get rid of the fraction, reduce to an *improper* fraction, and take the *nominator*, which, in this case is 20: one less (19) is the number of lines to be drawn through the square the other way. Again, suppose you wish to divide the three-quarters into six similar parts, then bisect the square one way, and draw $6 + \frac{6}{3} - 1 = 7$ lines, the other way; this square will, consequently, be divided into sixteen parts, and the second line will bound the quarter taken away, and each succeeding line one-sixth of the three-quarters to be divided.

I am, &c. J. F.

High-street, Southwark,
Sept. 20, 1824.

ANSWERS TO INQUIRIES

DECIPHERING INSCRIPTIONS.

SIR,---The following is the plan adopted by the celebrated antiquary, Mr. Brayley, in deciphering the inscriptions on the tombs in Westminster Abbey.

Take a sheet of tissue paper; hold it against, or lay it on, the stone, over the inscription; then take a rubber made of cloth, rolled up to about an inch in diameter, dip the end in powdered black-ball, rub it gently over the paper where the letters are, and the inscription will appear.

Sept. 13, 1824. T. E---TT.

P.S. I have enclosed a specimen of paper, and an inscription upon it, which is at the service of "Investigator," providing he will return it, as it is the only one I have left. By inspection he will perceive the process. [It is left with our Publishers for "Investigator's" inspection.---Edit.]

APPLE BREAD.

A very light pleasant bread is made in France by a mixture of apples and flour, in the proportion of one pound of the former to two of the latter. The usual quantity of yeast is employed as in making common bread, and is beat with flour and warm pulp of the apples after they have boiled, and the dough is then considered as set; it is then put up in a proper vessel, is allowed to rise for eight or twelve hours, and then baked into long loaves. Very little water is requisite; none, generally, if the apples are very fresh.

CHINESE METHOD OF MAKING SHEET-LEAD.

The Sheet-Lead which comes from China is manufactured in a way not generally known in this country. The operation is conducted by two men. One is seated on the floor, with a large flat stone before him, and with a moveable flat stone-stand at his side. His fellow-workman stands beside him with a crucible filled with melted lead, and having poured a certain quantity upon the stone, the other lifts the moveable stone, and dashing it on the fluid lead, presses it out into a flat and thin plate, which he instantly removes from the stone. A second quantity of lead is poured in a similar manner, and a similar plate formed; the process being carried on with singular rapidity. The rough edges of the plates are then cut off, and they are soldered together for use.

NEW PATENTS.

To Chas. Rardoin Baron de Berenger, of Target Cottage, Kentish Town, in the Parish of St. Pancras, Middlesex, for his improvement as to a new method or methods of applying percussion to the purpose of igniting charges in fire-arms generally, and in a novel and peculiar manner, whereby a reduction of the present high price of fire-arms can be effected, and the priming is also effectually protected against the influence of rain or other moisture; such invention and contrivances rendering the percussion principle more generally applicable even to common pistols, blunderbusses, and muskets, as well as to all sorts of sporting and other guns, by greatly reducing not only the charges of their manufacture, but also those impeding circumstances which persons have to encounter whilst loading or discharging fire-arms when in darkness, or whilst exposed to wet, or during rapid progress—serious impediments which soldiers and sailors, and consequently the service, more particularly and most injuriously experience.—Dated 27th July, 1824.—Two months allowed to enrol specification.

To Thomas Wolrich Stansfeld, of Leeds, Yorkshire, merchant, for certain improvements in power looms and the preparation of warps for the same.—27th July.—Six months.

To Charles Jefferies, of Havannah Mills, near Congleton, silk-thrower, and Edward Drakeford, of Congleton, watchmaker, both in the County of Chester, for their method of making a swift and other apparatus thereto belonging, for the purpose of winding silk and other fibrous materials.—29th July.—Two months.

To William Johnson, of Great Tothan, Essex, gentleman, for a means of evaporating fluids, for the purpose of conveying heat into buildings for manufacturing, horticultural, and domestic uses, and for heating liquors in distilling, brewing, and dyeing, and in making sugar and salt with reduced expenditure of fuel.—5th August.—Four months.

TO OUR READERS AND CORRESPONDENTS.

Owing to a delay in the engraving of the Titles to our Second Volume, we are obliged to postpone the publication of the Supplement, promised in our last, for two or three weeks.

The letter of B. T., on the Mechanics' Institution, is, at his own request, in consequence of "the perusal of our last week's publication," withdrawn.

T. M. B. could never expect that his last letter would find a place. It is needlessly abusive, and does not grapple with a single important fact in the case.

V. T.—The information to which he refers is still wanted.

"A Mechanic" will please to accept our thanks for his valuable hints; they shall be turned to account.

Communications received from—T I. Simpson—A Warm Supporter—Mr. Ellington—J. Taylor—Tenacity—T. B.—An Admirer—W Merrifield—Old File—Philo-Gunter—Pry—Jack Horner—S. P.—A Looker-on—Z. A.—Integritas—M.—D. M'F.—A Schoolmaster—N. O.—Bredy—W. Young.

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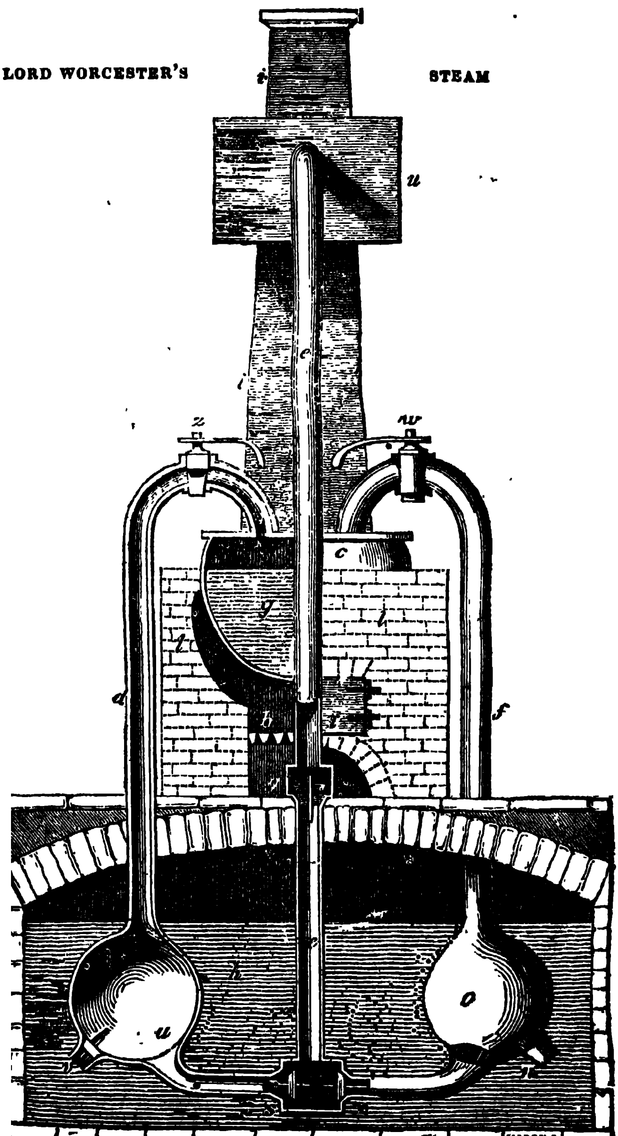
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

"The most valuable gift which the Hand of Science has ever yet offered to the Artisan." Dr. Birkbeck.

No. 58.] SATURDAY, OCTOBER 2, 1824. [Price 3d.

LORD WORCESTER'S STEAM



A Century of the Names and Scantlings of such Inventions as at present I can call to mind to have tried and perfected, which (my former Notes being lost) I have, at the instance of a powerful friend, endeavoured now, in the year 1655, to set down in such a way as may sufficiently instruct me to put any of them in practice. (1)

"Artis et Naturæ proles."

We were indebted, some time since, to an intelligent Correspondent (S. R.) for the suggestion that the republication, in our pages, of the Marquis of Worcester's celebrated Century of Inventions would render a valuable service to science, by making it more generally known to the mass of the community, and obtaining for it, in particular, more of the consideration of practical men than it has hitherto received; and, by the same gentleman, we were also kindly favoured with a correct transcript of a copy of the work in his possession, which we have since collated with a copy in the handwriting of the noble author himself, preserved in the Harleian MSS., at the British Museum, vol. 2428, and now present to our readers entire. From the readings in the foot-notes, which are those of the MS., it will be seen that the variations between the two authorities are mostly immaterial. In one instance, however (No. 88), the MS. has substituted quite a different invention from that in the printed copy; and one which is credible enough, while the other beggars all conception. Our Correspondent (S. R.) has appended to his transcript a number of original notes, illustrative of the Marquis's inventions, which, along with some other illustrations in our possession, and such additional ones as may from time to time be communicated to us (inviting hereby all who can throw any light on these "summary heads of wonderful things," to favour us with their observations), we propose to give in our subsequent numbers.

The author of this singular production, of whom our readers may not be displeased to know, previously, some particulars, was one of the most remarkable political characters of his age. He was "the famous Earl of Glamorgan, so created by Charles the First while heir-apparent to the Marquis of Worcester. He was a bigoted Catholic, but in times when that was no disrecommendation, and when it grew a merit. Being of a nature extremely enterprising, and a warm loyalist, he was dispatched into Ireland by the King. Here history lays its finger, at least is interrupted by controversy. The censurers of King Charles charge that Prince with sending this Lord to negociate with the Irish rebel Catholics, and to bring over a great body of them for the King's service. The devotees of Charles would disculpate him and accuse the Lord Glamorgan of forging powers from the King for that purpose. The fact stands thus: the treaty was discovered, the Earl was imprisoned by the King's servants in Ireland, and was dismissed by them, unpunished, before the King's pleasure was known. The Parliament complained; the King disavowed the Earl, yet renewed his confidence in him; nor did the Earl ever seem to resent the King's disavowal, which, with much good nature, he imputed to the necessities of his Majesty's affairs." *

The King, "with all his affection for the Earl, in one or two letters to others, mentions his want of judg-

(1). The following is the title in the MS. copy of the work, afterwards menmentioned:

From Aug. ye 29th to Sept. ye 21st, 1659.

A Centurie of the Names and Scantlings of such Inventions as att present I can call to mynde to have tryed and perfected my former Notes being lost; I have endeavoured to sett these down in such a way as may sufficiently instruct me to putt any of them in practice, having wherewith to do it.

* Walpole's Royal and Noble Authors.

ment. Perhaps his Majesty was glad to trust to his indiscretion. With *that* his Lordship seems (to have been) greatly furnished. We find him taking oaths upon oaths to the Pope's nuncio, with promises of unlimited obedience both to his Holiness and to his delegate, and begging five hundred pounds of the Irish Clergy, to enable him to embark and fetch fifty thousand pounds—like an alchemist, who demands a trifle of money for the secret of making gold. In another letter he promises two hundred thousand crowns, ten thousand arms for foot, two thousand cases of pistols, eight hundred barrels of powder, and thirty or forty well provided ships !! when he had not a groat in his purse, or as much gunpowder as would scare a corbie ! It is certain that he and his father wasted an immense sum in the King's cause; of all which merits and zeal his Majesty was so sensible, that he gave the Earl the most extraordinary patent, perhaps, that ever was granted; the chief powers of which were to make him Generalissimo of three armies and Admiral, with nomination of his officers, to enable him to raise money by selling his Majesty's woods, wardships, customs and prerogatives, and to create, by blank patents, to be filled up at Glamorgan's pleasure, from the rank of Baronet to that of Marquis. If any thing could justify the delegation of such authority, besides his Majesty having lost all authority when he conferred it, it was the promise with which the King concluded, of bestowing the Princess Elizabeth on Glamorgan's son. It was time to adopt into his family when he had into his sovereignty. This patent the Marquis, after the Restoration, gave up to the House of Peers. He did not long survive that era, dying in 1667."*

The Marquis's Century of Inventions, which we are now to lay before our Readers, was first printed in 12mo., in 1683. Walpole is pleased to designate it as an "amazing piece of folly;" but later and better informed writers have been led to think differently of it. Granger remarks—"That a practical mathematician, who has quickness to seize a hint and sagacity to apply it, might avail himself greatly of these Scantlings, though little more than a bare catalogue." And the same writer was informed by the late Reverend and ingenious mechanic, Mr. Gainsborough, of Henley, brother to the celebrated painter, that the Marquis's work was far from being such a collection of whims and chimeras as it has been supposed to be, and that, on the contrary, "he highly esteemed the author as one of the greatest mechanical geniuses that ever appeared in the world." It is quite certain, too, that since his time several of his "inventions" or suggestions have been reduced to practice; and hence the whole have become entitled to be treated with more respect. Professor Robison goes so far even as to affirm, that the steam-engine, the greatest discovery of modern times, "was, beyond all doubt, invented by the Marquis;" and though later researches have shown that this is somewhat unmerited praise, it is evident that he entertained views of the applicability of steam as a moving power, such as no other individual of the age in which he lived had the sagacity to embrace.

The "book" which he promises, at the conclusion of the Century, to leave to posterity, showing "the means to put in execution and visible trial all and every of these inventions, with the shape and form of all things belonging to them,—printed by brass plates," he did not live to execute. The drawing which we have given at the head of this article, as the Marquis's plan of a steam-engine, is an ideal sketch, designed by Professor Millington, from the account of the Century of Inventions (No. 68), with a slight alteration proposed by Mr. Stuart, in his Descriptive History of the Steam Engine--namely, that of substituting one pipe in the centre, for a pipe placed at each extremity, as in the Professor's arrangement. A more particular description of the Plate we reserve for our next number.

* Walpole.

TO THE KING'S MOST EXCELLENT MAJESTY.

SIR,—"*Scire meum nihil est, nisi me scire hoc sciat alter*," saith the poet, and I must justly, in order to your Majesty, whose satisfaction is my happiness and whom to serve is my only aim, placing therein my *summum bonum* in this world: be, therefore, pleased to cast your gracious eye over this summary collection, and then to pick and choose. I confess I made it but for the superficial satisfaction of a friend's curiosity, according as it is setdown; and if it might now serve to give aimto your Majesty how to make use of my poor endeavours, it would crown my thoughts, who am neither covetous nor ambitious but of deserving your Majesty's favour, upon my own cost and charges, yet, according to the old English proverb, "It is a poor dog not worth whistling after." Let but your Majesty approve, and I will effectually perform to the height of my understanding: vouchsafe but to command, and with my life and fortune I shall cheerfully obey, and, *maugre* envy, ignorance, and malice, ever appear your Majesty's passionately devoted, or, otherwise, disinterested subject and servant,

WORCESTER.

TO THE RIGHT HONOURABLE THE LORDS SPIRITUAL AND TEMPORAL, AND TO THE KNIGHTS, CITIZENS, AND BURGESSES OF THE HONOURABLE HOUSE OF COMMONS, NOW ASSEMBLED IN PARLIAMENT.

My Lords and Gentlemen,

Be not startled if I address to all, and every of you, this century of summary heads of wonderful things, even after the dedication of them to his most excellent Majesty, since it is with his most gracious and particular consent, as well as indeed no ways derogating from my duty to his sacred self, but rather in further order unto it, since your Lordships, who are his great council, and you, Gentlemen, his whole kingdom's representatives (most worthily welcome unto him), may fitly receive into your wise and serious considerations what doth or may publicly concern both his Majesty and his tenderly beloved people.

Pardon me if I say (my Lords and Gentlemen) that it is joyntly your parts to digest, to his hand, these ensuing particulars, fiting them to his palate, and ordering how to reduce them into practice in a way useful and beneficial both to his Majesty and his kingdom.

Neither do I esteem it less proper for me to present them to you, in order to his Majesty's service, than it is to give into the hands of a faithful and provident steward whatsoever dainties and provisions are intended for the master's diet; the knowing and faithful steward being best able to make use thereof to his master's contentment and greatest profit, keeping for the morrow whatever should be overplus or needless for the present day, or, at least, to save something else in lieu thereof. In a word (my Lords and Gentlemen), I humbly conceive this simile not improper, since you are his Majesty's provident stewards, into whose hands I commit myself with all properties fit to obey you, that is to say, with a heart harbouring no ambition, but an endless aim to serve my King and country; and if my endeavours prove effectual (as I am confident they will), his Majesty shall not only become rich, but his people likewise as treasures unto him; and his peerless Majesty, our King, shall become both beloved at home and feared abroad, deeming the riches of a King consist in the plenty enjoyed by his people.

And the way to render him to be feared abroad is, to content his people at home, who then, with heart and hand, are ready to assist him; and whatsoever God blesseth me with to contribute towards the increase of his revenues in any considerable way, I desire it may be employed to the use of his people; that is, for the taking off such taxes or burthens from them as they chiefly groan under, and by a temporary necessity only imposed upon them, which, being thus supplied, will certainly best content the King and satisfy his people, which, I dare say, is the continual end of all your indefatigable pains, and the perfect demonstration of your zele to his Majesty, and an evidence that the kingdom's trust is justly and deservedly reposed in you. And if ever Parliament acquitted themselves thereof, it is this of yours, composed of most deserving and qualified persons —qualified, I say, with affection to your Prince, and with a tenderness to his people; with a bountiful heart towards him, yet a frugality in their behalf.

Go on, therefore, chearfully (my Lords and Gentlemen), and not only our gracious King, but the King of Kings, will reward you; the prayers of the people will attend you; and his Majesty will, with thankful arms, embrace you. And be pleased to make use of me and my endeavours to enrich them, not myself. Such being my only request unto you, spare me not in what your wisdoms shall find me useful, who do esteem myself, not only by the act of the water-commanding engine (which so chearfully you have past), sufficiently rewarded, but likewise with courage enabled me to do ten times more for the future; and my debts being paid, and a competency to live according to my birth and quality settled, the rest shall I dedicate to the service of our King and country by your disposals; and esteem me not the more, or, rather, any more, by what is past, but what is to come; professing really, from my heart, that my intentions are to outgo the six or seven hundred thousand pounds already sacrificed, if countenanced and encouraged by you, ingenuously confessing that the melancholy which hath lately seized me (the cause whereof none of you but may easily guess) hath, I dare say, retarded more advantages to the public service than modesty will permit me to utter; and now, revived by your promising favours, I shall infallibly be enabled thereunto in the experiments extant and comprised under these heads, practicable with my directions by the unparalleled workman, both for trust and skill, Caspar Kaltoff's hand, who has been these five-and-thirty years as in a school, under me employed, and still at my disposal, in a place by my great expenses made fit for public service, yet lately like to be taken from me, and consequently from the service of King and kingdom, without the least regard of about ten thousand pounds expended by me, and through my zeal, to the common good; my zeal, I say, a field large enough for you (my Lords and Gentlemen) to work upon.

The treasures buried under these heads, both for war, peace, and pleasure, being inexhaustible, I beseech you pardon me if I say so. It seems a vanity, but it comprehends a truth, since no good spring but becomes the more plentiful by how much more it is drawn, and the spinner to weave his webb is never stinted but further inforced.

The more than that you shall be pleased to make use of my inventions, the more inventive shall you ever find me; one invention begetting still another, and more and more improving my ability to serve my King and you; and as to my heartiness therein, there needs no addition, nor to my readiness a spur. And therefore (my Lords and Gentlemen) be pleased to begin, and desist not from commanding me till I flag in my obedience and endeavours to serve my king and country:

For certainly you'll find me breathless first t'expire,
Before my hands grow weary, or my legs do tire

Yet, abstracting from any interest of my own, but as a fellow-subject and compatriot, will I ever labour in the vineyard, most heartily and readily obeying the least summons from you, by putting faithfully in execution what your judgments shall think fit to pitch upon amongst this century of experiments, perhaps dearly purchased by me, but now frankly and *gratis* offered to you. Since my heart (methinks) cannot be satisfied in serving my King and country, if it should cost them any thing, as I confess, when I had the honour to be near so obliging a master as his late Majesty, of happy memory, who never refused me his ear to any reasonable motion; and as for unreasonable ones, or such as were not fitting for him to grant, I would rather have to dyed a thousand deaths then ever to have made one unto him.

Yet whatever I was so happy as to obtain for any deserving person, my pains, breath, and interest, imployed therein, satisfied me not, unless I likewise satisfied the fees; but that was in my golden age. And even now, though my ability and means are shortened (the world knows why), my heart remains still the same; and be you pleased (my Lords and Gentlemen) to rest most assured, that the very complacency that I shall take in the executing your commands shall be unto me a sufficient and abundantly satisfactory reward.

Vouchsafe, therefore, to dispose freely of me, and whatever lieth in my power to perform—first, in order to his Majesty's service; secondly, for the good and advantage of the kingdom; thirdly, to all your satisfactions, for particular profit and pleasure to your individual selves: professing that, in all and each of the three respects, I will ever demean myself as it best becomes,

My Lords and Gentlemen,

Your most passionately bent fellow-subject in his Majesty's service, compatriot for the public good and advantage, and a most humble servant to all and every of you,

WORCESTER.

A CENTURY OF THE NAMES AND SCANTLINGS OF INVENTIONS BY ME ALREADY PRACTISED.

1. Several sorts of seals, some shewing by screws, others by gages fastening or unfastening all the marks at once, others by additional points and imaginary places, proportionable to ordinary escocheons and seals to arms, each way palpably and punctually setting down (yet private from all others but the owner and by his assent) the day of the month, the day of the week, the month of the year, the year of our Lord, the names of the witnesses, and the individual place where any thing was sealed, though in ten thousand several places, together with the very number of lines contained in a contract, whereby falsification may be discovered and manifestly proved, being upon good grounds suspected.

Upon any of these seals a man may keep accounts of receipts and disbursements, from one farthing to an hundred millions, punctually shewing each pound, shilling, penny, or farthing.

By these seals, likewise, any letter, though written but in English, may be read and understood in eight several languages, and in English itself to clean contrary and different sense, unknown to any but the correspondent, and not to be read or understood by him neither, if opened before it arrives unto him; so that neither threats nor hopes of reward can make him reveal the secret, the letter having been intercepted and first opened by the enemy.

2. How ten thousand persons may use those seals to all and every of the purposes aforesaid, and keep their secrets from any but whom they please.

3. A cypher and character so contrived that one line, without returns and circumflexes, stands for each and every of the 24 letters, and as ready to be made for the one letter as the other.

4. This invention refined, and so abbreviated that a point only sheweth distinctly and significantly any of the 24 letters, and these very points to be made with two pens; so that no time will be lost, but as one finger riseth, the other may make the following letter, never clogging the memory with several figures for words and combinations of letters, which with ease, and void of confusion, are thus speedily and punctually, letter for letter, set down by naked and not multiplied points. And nothing can be less than a point, the mathematical definition of it being, *cujus pars nulla*. And of a motion no swifter imaginable than semiquavers or releshes, yet applicable to this manner of writing.

5. A way, by circular motion, either along a rule or ringwise, to vary any alphabet, even this of points, so that the self-same point, individually placed, without the least additional mark or variation of place, shall stand for all the 24 letters, and not for the same letter twice in ten sheets writing, yet as easily and certainly read and known as if it stood but for one and the self-same letter constantly signified.

6. How, at a window, as far as eye can discover black from white, a man may hold discourse with his correspondent, without noise made or notice taken; being, according to the occasion given and means afforded, *ex re nata*, and no need of provision beforehand, though much better if foreseen, and means prepared for it, and a premeditated course taken by mutual consent of parties.

7. A way to do it by night as well as by day, though as dark as pitch is black.

8. A way how to level and shoot cannon by night as well as by day, and as directly, without a platform or measures taken by day, yet by a plain and infallible rule.

9. An engine portable in one's pocket, which may be carried and fastened on the inside of the greatest ship, *tanquam aliud agens*, and, at any appointed minute, though a week after, either of day or night, it shall irrecoverably sink that ship.

10. A way, from a mile off, to dive and fasten a like engine to any ship, so as it may punctually work the same effect either for time or execution.

11. How to prevent and safeguard any ship from such an attempt by day or night.

12. A way to make a ship not possible to be sunk, though shot an hundred times betwixt wind and water by cannon, and should lose a whole plank, yet, in half an hour's time, should be made as fit to sail as before.

13. How to make such false decks as, in a moment, should kill and take prisoners as many as should board the ship, without blowing the decks up, or destroying them, from being reducible, and in a quarter of an hour's time should recover their former shape, and to be made fit for any employment, without discovering the secret.

14. How to bring a force to weigh up an anchor, or to do any forcible exploit, in the narrowest or lowest room in any ship, where few hands shall do the work of many; and many hands applicable to the same force, some standing, others sitting, and, by virtue of their several helps, a great force augmented in little room, as effectual as if there were sufficient space to go about with an axletree, and work far from the centre.

15. A way to make a boat work itself against wind and tide, yea, both without the help of man or beast; yet so that the wind or tide, though directly opposite, shall force the ship or boat against itself, and in no point of the com-

pass, but it shall be as effectual as if the wind were in the *pupp*, or the stream actually with the course it is to steer, according to which the oars shall row, and necessary motions work and move, towards the desired port or point of the compass.

16. How to make a sea-castle, or fortification, cannon proof, and capable of containing a thousand men, yet sailable at pleasure to defend a passage; or, in an hour's time, to divide itself into three ships, as fit and trimmed to sail as before; and even whilst it is a fort or castle they shall be unanimously steered, and effectually be driven, by an indifferent strong wind.

17. How to make upon the Thames a floating garden of pleasure, with trees, flowers, banqueting-houses, and fountains, stews for all kinds of fishes, a reserve for snow to keep wine in, delicate bathing places, and the like; with music made with (2) mills, and all in the midst of the stream, where it is most rapid.

18. An artificial fountain, to be turned, like an hour glass, by a child in the twinkling of an eye, it holding a great quantity of water, and of force sufficient to make snow, ice, and thunder, with a chirping and singing of birds, and shewing of several shapes and effects usual to fountains of pleasure.

19. A little engine within a coach, whereby a child may stop it, and secure all persons within it, and the coachman himself, though the horses be never so unruly in a full career; a child being sufficiently capable to loosen them in what posture soever they should have put themselves, turning never so short, for a child can do it in the twinkling of an eye.

20. How to bring up water balancewise, so that as little weight or force as will turn a balance will be only needful, more than the weight of the water within the buckets, which, counterpoised, empty (3) themselves one into the other, the uppermost yielding its water (how great a quantity soever it holds) at the selfsame time the lowermost taketh it in, though it be an hundred fathom high.

21. How to raise water constantly with two buckets only, day and night, without any other force than its own motion, using not so much as any force, wheel or sucker, nor more pulleys than one, on which the cord or chain rolleth, with a bucket fastened at each end. This, I confess, I have seen and learned of the great mathematician Claudius (4) his Studies at Rome, he having made a present thereof unto a Cardinal; and I desire not to own any other men's inventions, but if I set down any, to nominate likewise the inventor.

22. To make a river in a garden to ebb and flow constantly, though twenty foot over, with a child's force, in some private room, or place out of sight, and a competent distance from it.

23. To set a clock in (5) a castle, the water filling the trenches about it; it shall shew, by ebbing and flowing, the hours, minutes, and seconds, and all the comprehensible motions of the heavens, and counterlibration of the earth, according to Copernicus.

24. How to increase the strength of a spring to such an height as to shoot bumbasses and bullets of an hundred pound weight a steeple height, and a quarter of a mile off, and more, stone bowwise; admirable for fire-works, and astonishing of besieged cities, when, without warning given by noise, they find themselves so forcibly and dangerously surprised.

25. How to make a weight that cannot take up an hundred pound, and yet shall take up two hundred pound, and at the selfsame distance from the centre; and so, proportionably, to millions of pounds.

26. To raise weight as well and as forcibly with the drawing back of the lever, as with the thrusting it forwards; and, by that means, to lose no time in motion or strength. This I saw in the arsenal at Venice.

27. A way to move to and fro huge weights, with a most inconsiderable strength, from place to place. For example, ten ton with ten pounds, and less; the said ten pounds not to fall lower than it makes the ten ton to advance or retreat upon a level.

28. A bridge, portable in (6) a cart with six horses, which in a few hours time may be placed over a river half a mile broad, whereon with much expedition may be transported horse, foot, and cannon.

29. A portable fortification, able to contain five hundred fighting men, and yet, in six hours time, may be set up and made cannon-proof, upon the side of a river or pass, with cannon mounted upon it, and as complete as a regular fortification, with half-moons and counterscarps.

30. A way, in one night's time, to raise a bulwark twenty or thirty foot high, cannon-proof, and cannon mounted upon it, with men to overlook, command, and batter a town; for though it contain but four pieces, they shall be able to discharge two hundred bullets each hour.

31. A way how, safely and speedily, to make an approach to a castle or town wall, and over the very ditch, at noon day.

32. How to compose an universal character, methodical and easy to be written, yet intelligible in any language; so that if an Englishman write it in English, a Frenchman, Italian, Spaniard, Irish, Welch, being scholars, yea, Grecian or Hebrean, shall as perfectly understand it in their own tongue as if they were perfect English, distinguishing the verbs from nouns, the numbers, tenses, and cases, as properly expressed in their own language as it was written in English.

33. To write with a needle and thread, white or any colour, upon white, or any other colour so that one stitch shall significantly shew any letter, and as readily and as easily shew the one letter as the other, and fit for any language

34. To write by a knotted silk string, so that every knot shall signify any letter, with comma, full point, or interrogation, and as legible as with pen and ink upon white paper.

35. The like, by the fringe of gloves.

36. By stringing of bracelets.

37. By pink'd gloves.

38. By holes in the bottom of a sieve.

39. By a lattin, or plate lanthorn (7).

40. By the smell.

41. By the taste.

42. By the touch.

Note.—By these three senses, as perfectly, distinctly, and unconfusedly, yea, as readily as by the sight.

43. How to vary each of these, so that ten thousand may know them, and yet keep the understanding part from any but their correspondent.

44. To make a key of a chamber-door, which to your sight hath its wards and rosepipe but paper thick, and yet at pleasure, in a minute of an hour, shall become a perfect pistol, capable to shoot through a breast-plate commonly of carabine proof, with prime, powder, and fire-lock, and is coverable in a stranger's hand.

45. How to light a fire and candle at what hour of the night one waketh, without rising or putting one's hand out of the bed. And the

(2) "By," MS. copy.
(3) "Counterpoised and empty."
(4) "Clavius."
(5) "As within."

(6) "Upon."
(7) "Candlestick lantern."

same thing becomes (8) a serviceable pistol at pleasure; yet by a stranger, not knowing the secret, seemeth but a dexterous tinder-box.

46. How to make an artificial bird, to fly which way and as long as one pleaseth, by or against the wind, sometimes chirping, other times hovering, still tending the way it is designed for.

47. To make a ball of any metal, which, thrown into a pool or pail of water, shall presently rise from the bottom, and constantly show, by the superficies of the water, the hour of the day or night, never rising more out of the water than just to the minute it sheweth of each quarter of the hour; and if by force kept under water, yet the time is not lost, but recovered as soon as it is permitted to rise to the superficies of the water.

48. A screwed ascent, instead of stairs, with fit landing-places to the best chambers of each story, with back stairs within the noell of it, convenient for servants to pass up and down to the inward rooms of them, unseen and private.

49. A portable engine, in the way of a tobacco-tongs, whereby a man may get over a wall, or get up again, being come down, finding the coast proving unsecure to him.

50. A complete light portable ladder, which, taken out of one's pocket, may be by himself fastened an hundred foot high, to get up by from the ground.

51. A rule of gradation, which with ease and method reduceth all things to a private correspondence, most useful for secret intelligence.

52. How to signify words, and a perfect discourse, by jangling of bells of any parish church, or by any musical instrument within hearing, in a seeming way of tuneing it, or of an unskilful beginner.

53. A way how to make hollow and cover a water-screw, as big and as long as one pleaseth, in an easy and cheap way.

54. How to make a water-screw tight, and yet transparent and free from breaking, but so clear that one may palpably see the water, or any heavy thing, how and why it is mounted by turning.

55. A double water-screw, the innermost to mount the water, and the outermost for it to descend more in number of threads, and, consequently, in quantity of water, though much shorter than the innermost screw, by which the water ascendeth—a most extraordinary help for the turning of the screw to make the water rise.

56. To provide and make, that all the weights of the descending side of a wheel shall be perpetually further from the center than those of the mounting side, and yet equal in number and heft to (9) the one side as the other. A most incredible thing, if not seen, but tried before the late King (of blessed memory) (10) in the Tower, by my directions, two extraordinary Embassadors accompanying his Majesty, and the Duke of Richmond and Duke Hamilton, with most of the Court attending him. The wheel was 14 foot over, and 40 weights, of 50 pounds a-piece. Sir William Balfore, (11) then Lieutenant of the Tower, can justify it, with several others. They all saw, that no sooner the great weights passed the diameter line of the lower (12) side, but they hung a foot further from the center; nor no sooner passed the diameter line of the upper side, but they hung a foot nearer. Be pleased to (13) judge the consequence.

57. An ebbing and flowing water-work, in two vessels, into either of which, the water standing at a level, if a globe be cast in, instead of rising it presently ebbeth, and so remaineth until a like globe be cast into the other vessel, which the water is no sooner sensible of, but that (14) vessel presently ebbeth, and the other floweth, and so continueth ebbing and flowing until one or both of the globes be taken out, working some little effect besides its own motion, without the help of any man within sight or hearing: but if either of the globes be taken out, with ever so swift or easy a motion, at the very instant the ebbing and flowing ceaseth; for if, during the ebbing, you take out the globe, the water of that vessel presently returneth to flow, and never ebbeth after, until the globe be returned into it, and then the motion beginneth as before.

58. How to make a pistol discharge a dozen times with one loading, and without so much as once new priming requisite, or to change it out of one hand into the other, or stop one's horse.

59. Another way, as fast and effectual, but more proper for carabines.

60. A way, with a flask appropriated unto it, which will furnish either pistol or carabine with a dozen charges in three minutes' time, to do the whole execution of a dozen shots, as soon as one pleaseth, proportionably.

61. A third way, and particular for musquets, without taking them from their rests to charge or prime, to a like execution, and as fast as the flask, the musquet containing but one charge at a time.

62. A way for a harquebuss, a crock, or ship musket, six upon a carriage, shooting with such expedition, as, without danger, one may charge, level, and discharge them, sixty times in a minute of an hour, two or three together.

63. A sixth way, most excellent for sakers, differing from the other, yet as swift.

64. A seventh, tried and approved before the late King (of ever blessed memory), and a hundred Lords and Commons, in a cannon of eight inches half quarter, to shoot bullets of 64 pounds weight, and 24 pounds of powder, twenty times in six minutes, so clear from danger, that, after all were discharged, a pound of butter did not melt, being laid upon the cannon britch, nor the green oil discoloured that was first anointed and used between the barrel thereof, and the engine having never in it, nor within six foot of it, but one charge at a time.

65. A way that one man, in the cabbin, may govern the whole side of ship musquets, to the number (if need require) of 2 or 3000 shots.

66. A way that, against several avenues to a fort or castle, one man may charge 50 cannons playing, and stopping when he pleaseth, though out of sight of the cannon.

67. A rare way, likewise, for musquetoons fastened to the pummel of the saddle, so that a common trooper cannot miss to charge them with twenty or thirty bullets at a time, even in full career.

"When I first gave my thoughts to make "guns shoot often, I thought there had been "but one only exquisite way inventible, yet "by several trials, and much charge, I have "perfectly tried all these."

68. An admirable and most forcible way to drive up water by fire, not by drawing or sucking it upwards, for that must be, as the philosopher calleth it, *infra sphæram activitatis*, which is but at such a distance. But this way hath no bounder, if the vessels be strong enough; for I have taken a piece of a whole cannon,

(8) "To be."
(9) "Of."
(10) "Of happy and glorious &c.
(11) "Sir W. Belford."
(12) "Upper."
(13) "Lower."

(14) "The."

whereof the end was burst, and filled it three-quarters full of water,(15) stopping and screwing up the broken end, as also the touch-hole, and making a constant fire under it, within 24 hours it burst, and made a great crack: so that having a way (16) to make my vessels, so that they are strengthened by the force within them, and the one to fill after the other, I have seen the water run like a constant fountain-stream, 40 foot high; one vessel of water, rarified by fire, driving up 40 of cold water. And a man that tends the work is but to turn two cocks, that one vessel of water being consumed, another to force and refill with cold water, and so successively, the fire being tended and kept constant, which the selfsame person may likewise abundantly perform in the interim between the necessity of turning the said cocks.

69. A way how a little triangle screwed key, not weighing a shilling, shall be capable (17) and strong enough to bolt and unbolt, round about a great chest, an hundred bolts, through 50 staples, two in each, with a direct contrary motion, and as many more from both sides and ends; and, at the selfsame time, shall fasten it to the place, beyond a man's natural strength to take it away; and, in one and the same turn, both locketh and openeth it.

70. A key, with a rose-turning pipe, and two roses, pierced through endwise the bit thereof, (18) with several handsomely contrived wards, which may likewise do the same effects.

71. A key perfectly square, with a screw turning within it, and more conceited than any of the rest, and no heavier than the triangle-screwed key, and doth the same effects.

72. An escutcheon to be placed before any of these locks, with these properties:—

1st, The owner (though a woman) may, with her delicate hand, vary the ways of coming to open the lock ten millions of times, beyond the knowledge of the smith that made it, or of me who invented it.

2d. If a stranger open it, it setteth an alarm a going, which the stranger cannot stop from running out; and, besides, though none should be within hearing, yet it catcheth his hand, as a trap doth a fox; and though far from maiming him, yet it leaveth such a mark behind it, as will discover him if suspected; the escutcheon, or lock, plainly shewing what monies he hath taken out of the box to a farthing, and how many times opened since the owner had been at it.

73. A transmittable gallery over any ditch or breach in a town wall, with a blind and parapit cannon proof.

74 A door, whereof the turning of the key, with the help and motion of the handle, makes the hinges to be of either side, and to open either inward or outward, as one is to enter or to go out, or to open in half.

75. How a tape or ribbon-weaver may set down a whole discourse, without knowing a letter, or interweaving any thing suspicious of other secret than a new-fashioned ribbon.

76. How to write in the dark as straight as by day or candle-light.

77. How to make a man to fly, which I have tried with a little boy of ten years old in a barn, from one end to the other, on an hay-mow.

78. A watch to go constantly, and yet needs no other winding from the first setting on the cord or chain, unless it be broken, requiring no other care from one man than to be now and then consulted with concerning the hour of the day or night; and if it be laid by a week together, it will not err much, but the oftener looked upon the more exact it sheweth the time of the day or night.

79. A way to lock all the boxes of a cabinet (though never so many) at one time, which were by particular keys, appropriated to each lock, opened severally and independent the one of the other, as much as concerneth the opening of them, and by these means cannot be left open unawares.

80. How to make a pistol barrel no thicker than a shilling, and yet able to endure a musquet proof of powder and bullet.

81. A combe-conveyance carrying of letters, without suspicion, the head being opened with a needle-screw drawing a spring towards them, (19) the combe being made but after an usual form carried in one's pocket.

82. A knife, spoon, or fork, in an usual portable case, may have the like conveyances in their handles.

83. A raspin-mill, for hartshorn, whereby a child may do the work of half-a-dozen men, commonly taken up with that work.

84. An instrument, whereby persons ignorant in arithmetick may perfectly observe numerations and substractions of all sums and fractions.

85. A little ball, made in the shape of a plum or pear, being (20) dexterously conveyed or forced into a body's mouth, shall presently shoot forth such and so many bolts of each side and at both ends, as, without the owner's key, can neither be opened or filed off, being made of tempered steel, and as effectually locked as an iron chest.

86. A chair, made *a-la-mode*, and yet a stranger being persuaded to sit down in't, shall have immediately his arms and thighs locked up beyond his own power to loosen them.

87. A brass mould, to cast candles, in which a man may make 500 dozen in a day, and add an ingredient to the tallow, which will make it cheaper, and yet so that the candles shall look whiter and last longer.

88. (21) How to make a brazen or stone head, in the midst of a great field or garden, so artificial and natural, that though a man speak never so softly, and even whispers into the ear thereof, it will presently open its mouth, and resolve the question in French, Latin, Welch, Irish, or English, in good terms uttering out of his mouth, and then shut it until the next question be asked.

89. White silk, knotted in the fingers of a pair of white gloves, and so contrived, without suspicion, that playing at primero, at cards, one may, without clogging his memory, keep reckoning of all sixes, sevens, and aces, which he hath discarded. (22).

90. A most dexterous dicing-box, with holes transparent, after the usual fashion, with a device so dexterous, that, with a knock of it against the table, the four good dice are fastened, and it looseneth four false dice made fit for the purpose.

91. An artificial horse, with saddle and caparizons fit for running at the ring, on which a man being mounted, with his lance in his hand, he can at pleasure make him start, and swiftly run his career, using the decent posture with *bon grace*, may take the ring as handsomely, and running as swiftly, as if he rode upon a barbe.

(15) "Full"—merely.
(16) "Found a way."
(17) "Triangle *and* screwed key shall be capable."
(18) "Together."
(19) "One."
(20) "Which being."
(21). "An engin without ye least noyse, knock, or use of fyre, to coyne and stamp 100lb. in an houre by one man."
(22). "Without foul play."

92. A screw, made like a water-screw, but the bottom made of iron plate, spade-wise, which, at the side of a boat, emptieth the mud of a pond, or raiseth gravel.

93. An engine, whereby one man may take out of the water a ship of 500 ton, so that it may be calked, trimmed, and repaired, without need of the usual way of stocks, and as easily let it down again.

94. A little engine, portable in one's pocket, which, placed to any door, without any noise but one crack, openeth any door or gate.

95. A double cross-bow, neat, handsome, and strong, to shoot two arrows, either together, or one after the other, so immediately, that a deer cannot run two steps, but, if he miss of one arrow, he may be reached with the other, whether the deer run forward, sideward, or start backward.

96. A way to make a sea-bank so firm and geometrically strong, so that a stream can have no power over it; excellent, likewise, to save the pillar of a bridge, being cheaper and stronger than stone walls.

97. An instrument whereby an ignorant person may take any thing in perspective as justly, and more, than the skilfullest painter can do by his eye.

98. An engine, so contrived, that working the *primum mobile* forward or backward, upward or downward, circularly or cornerwise, to and fro, streight, upright, or downright, yet the pretended operation continueth, and advanceth none of the motions above-mentioned, hindering, much less stopping, the other; but unanimously and with harmony agreeing, they all augment and contribute strength unto the intended work and operation; and, therefore, I call this a *semi-omnipotent engine*, and do intend that a model thereof be buried with me.

99. How to make one pound weight to raise an hundred as high as one pound falleth, and yet the hundred pound descending doth what nothing less than one hundred pound can effect.

100. Upon so potent a help as these two last-mentioned inventions, a water-work is, by many years experience and labour, so advantageously by me contrived, that a child's force bringeth up, an hundred foot high, an incredible quantity of water, even two foot diameter, *so naturally, that the work will not be heard, even into the next room; and with so great ease and geometrical symmetry, that though it work day and night, from one end of the year to the other, it will not require forty shillings reparation to the whole engine, nor hinder one's day-work;* (23) and I may boldly call it the most stupendous work in the whole world: not only, with little charge, to drain all sorts of mines, and furnish cities with water, though never so high seated, as well to keep them sweet, running through several streets, and so performing the work of scavengers, as well as furnishing the inhabitants with sufficient water for their private occasions; but likewise supplying rivers with sufficient to maintain and make them portable from town to town, and for the bettering of lands all the way it runs; with many more advantageous and yet greater effects of profit admirable and consequence. So that deservedly I deem this invention to crown my labours, to reward my expences, and make my thoughts acquiesce in way of further inventions; this making up the whole century, and preventing any further trouble to the reader for the present, meaning to leave to posterity a book, wherein, under each of these heads, the means to put in execution, and visible trial, all and every of these inventions, with the shape and form of all things belonging to them, shall be printed by brass plates.

In bonum publicum, et ad majorem Dei gloriam. (24).

THE CONTENTS. (25)

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(23). The words marked in Italics not in the M.S.

(24). "Besydes many omitted, and some of of three sorts willingly not set downe, as not fitt to be divulged, least ill use may bee made thereof; butt to shew that such things are also within my knowledge, I will here in my re own cypher set down one of each, not to be concealed when duty and affection obligeth me"

(25). "Index."

(26). A *mute* yet perfect discourse, as far distant as eye can reach by day to discern colours."

(27). "Though never soe darke."

(28). "Multiplying."

(29). "Flowing clock."

(30). *For weights*—wanting in the MS.

(31). *And each of these*—wanting.

A flask charger 60
A way for musquets 61
A way for a harquebuss, or crock 62
For sakers (32) and minyons 63
For the biggest cannon (33) 64
For a whole side of (34) ship musquets.... 65
For guarding several avenues to a town.... 66
For musquetoons on horseback 67
A fire water-work.......................... 68
A triangle key.............................. 69
A rose key.................................. 70
A square key, with a turning screw........ 71
An escutcheon for all locks................ 72
A transmittable gallery.................... 73
A conceited door........................... 74
A discourse woven in tape or ribbon (35) ... 75
To write in the dark....................... 76
A flying man............................... 77
A continually-going watch (36) 78
A total (37) locking of cabinet-boxes 79
Light pistol barrels 80
A combe-conveyance for letters ...... (38) 81
A knife, spoon, or fork conveyance.... (38) 82
A rasping-mill 83
An arithmetical instrument................ 84
An untoothsome pear 85
An imprisoning chair 86
A candle mould 87
A brazen head, or speaking figure (39) 88
Primero gloves (40) 89
A dicing-box (41) 90
An artificial ring-horse 91
A gravel engine 92
A ship raising engine 93
A pocket engine to open any door 94
A double cross-bow 95
A way for sea banks....................... 96
A perspective instrument 97
A semi-omnipotent engine 98
A most admirable way to raise weights (42) 99
A stupendous water-work..................100

HIGH PRESSURE STEAM-ENGINES.

The following documents will be found of considerable importance, in relation to a question which has been much agitated in this country, as well as in America, namely, whether High Pressure Engines can be employed with safety in steam navigation?

REPORT

Of the Committee on Commerce (of the Congress of the United States), accompanied by a Bill for regulating of Steam Boats, and for the Security of Passengers therein.—May 22, 1824.

The Committee of Commerce, to which was referred a resolution instructing them to inquire into the expediency of providing by law, that no licence to navigate any of the waters of the United States shall be granted to any boat or vessel, hereafter built, and moved or propelled by fire or steam, upon the principle of construction commonly called "high pressure;" nor to any boat or vessel heretofore built, and moved or propelled by fire or steam, that shall hereafter be fitted up or provided with any engine or other machine, intended to move or propel such boat or vessel, upon the principle of construction aforesaid, respectfully Report:

That they entered upon the investigation of this subject with a deep sense of its importance, and a strong conviction of the great difficulties attending any legislative interference with the management of so extensive a branch of business.

The power of steam to propel boats, which was first successfully applied to practical purposes in the United States, is now in extensive and general use on all the waters of the Union; its application on the great rivers of the Mississippi and Ohio, has contributed in an eminent degree to the prosperity and advancement of the States through which they flow.

To what farther application the agency of steam is capable, and to what extent it may be carried by the science and ingenuity of our mechanicians, cannot be anticipated; and your Committee felt averse to fetter or discourage the ingenuity and skill for which the artists of this country are so distinguished; nothing, therefore, but a consideration of what is due to the protection of individuals, whose safety may be endangered by ignorance, avarice, or inattention, from which they have not the power to protect themselves, induces your Committee to recommend the interposition of Congress.

Your Committee believe it to be the universal opinion of all persons conversant in such subjects, that steam-engines, of a certain construction, may be applied to passage-boats with the most perfect security to the passengers.

The low pressure engine (commonly known as the engine of Bolton and Watt) consists, besides the boiler and cylinder, of an air-pump and condenser; on opening the communication with the condenser, the steam on one side of the piston, in the cylinder, is condensed by this process, the water in the condenser becomes heated, and is drawn off by the air-pump, and its place supplied by cold water, which again condenses the steam now collected on the other side of the piston. The size of the air-pump is calculated to free the condenser of a certain quantity of water only, in proportion to the size of the cylinder; and as this quantity of water, at the usual temperature, can only condense a specific quantity of

(32). Forsacres.
(33). "For whole canon."
(34). *A whole side of*—wanting.
(35) *Or ribbon*—wanting.
(36). "A continual watch."
(37). *A total*—wanting.
(38). "81, 82. Conveyance for letters."
(39). Wanting entirely in the M.S.
(40). "Stamping engine."
(41). "Primero gloves." The Marquis seems to have been in doubt which he should erase—the brazen head or the dicing-box.
(42). Wanting in the M.S.

steam, if the steam from the boiler is furnished of an extremely high temperature, the vacuum of the cylinder will not be perfect, and, consequently, the engine will not materially gain in power by increasing the force of the steam, the additional pressure being not more than equal to the loss from an imperfect vacuum. The condensing engine, therefore, when constructed on proper principles, merely requires a pressure of steam equal to that of the atmosphere, in order to drive out the atmospheric air, and to supply its place with steam, which, being condensed, forms the vacuum, giving a pressure of about 14 lbs. on the square inch. It will readily be perceived, therefore, that with low pressure engines, there is little inducement to increase the pressure of steam in the boiler; and as the utmost that can be produced by the common boiler of Bolton and Watt's engine does not exceed 15 or 18 lbs. on the square inch, there is less danger of bursting them, and the damage arising from such an accident is seldom more than rending the boiler, and scalding those in its immediate vicinity, without doing any injury to the boat or passengers in the cabin. The high pressure engines are driven entirely by the force of the steam, without any assistance from a vacuum, and are usually calculated for a pressure of from 40 to 100 lbs. to the square inch, on which the power of the engine is calculated; but, in case of emergency, the force may be multiplied to any extent to which the temperature of steam may be raised; so that an engine of 20 horse power may be made to perform the work of a 40, or even of 100 horse power. This effect, however, is produced at the risk of bursting the boiler, and endangering the lives of the passengers.

From habitual impunity, the engine-workers disregard the danger, and rather than suffer a boat to pass them, will increase the pressure of the steam to a dangerous extent. In addition to this risk, accidents may occur from carelessness, inattention, or drunkenness.

On land, the high pressure engine is not subject to the same objections. The power of the steam, in the first instance, is calculated for the work to be done in the mills, and the inducement to augment it is not very great.

Many respectable mechanics and engineers in this country for some time considered that the improved boiler, invented by Oliver Evans, obviated the objections to high pressure engines. The late melancholy occurrence on board the Etna, in the waters of New York harbour, must have undeceived them. The engine in this boat was constructed on the plan of that skilful mechanic, and was furnished with all the guards his ingenuity could devise.

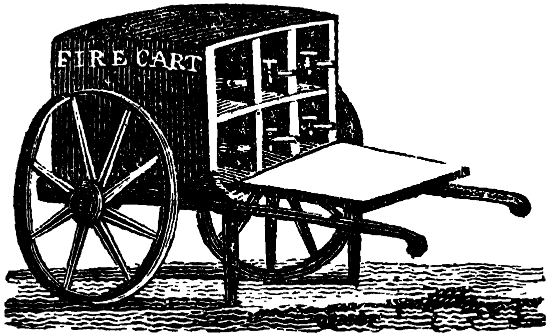
Your Committee, from this view of the subject, are decidedly of opinion, that high pressure engines, under any guard that could be applied to them, are not as safe to use in boats as those of low pressure. But, as a vast amount of property is vested in boats propelled by high pressure steam-engines, especially on the Mississippi and Ohio rivers, they forbear to recommend the adoption of any measure which would go to prohibit their use. In boats loaded differently, at different times, and navigating streams where the current is often of unequal velocity, it may be advantageous to use an engine capable of receiving an additional power. In order, however, to give them all the security of which they are susceptible, they recommend that all boats propelled by steam should be enrolled at the port nearest to the place from or to which they proceed, and should be compelled to take out a coasting licence. That every boiler on board such steam boats should be composed of wrought iron or copper. The strength of a cast iron boiler is uncertain. Cast iron being liable to contract in various degrees, in different places, and is, therefore, more liable to break than wrought iron; and in the event of bursting, the fragments are scattered about with great force, whereas in the bursting of a boiler of malleable metal, a simple rending generally takes place, unless under a pressure of steam exceeding 2 or 300lbs. to the square inch.

That every boiler on board such boat should, previous to the boat being used for the conveyance of passengers, be submitted to the inspection of one or more skilful engineers, or other persons conversant with the subject, who should ascertain, by trial, the strength of such boiler, and should certify his opinion of its sufficient strength, and of the security with which it might be employed, to the extent proposed. That every such boiler should be provided with two sufficient safety valves, one of which should be inaccessible to the engine-worker, and the other inaccessible to him and the persons on board the boat. The inspectors to examine the safety valves, and certify what is the pressure at which such safety valves shall open, which pressure shall not exceed one-third of that by which the boiler has been proved, nor one-sixth of that which, by calculation, it shall be reckoned able to sustain in high pressure steam-engines; nor one-half the pressure by which the boiler has been proved, nor one-third of what, by calculation, it shall be reckoned able to sustain, if a low pressure engine. That a penalty shall be inflicted on any person placing additional weight on either of the safety valves.

(To be continued.)

PLAN FOR THE SPEEDY EXTINCTION OF FIRES;

BY CAPTAIN MANBY.

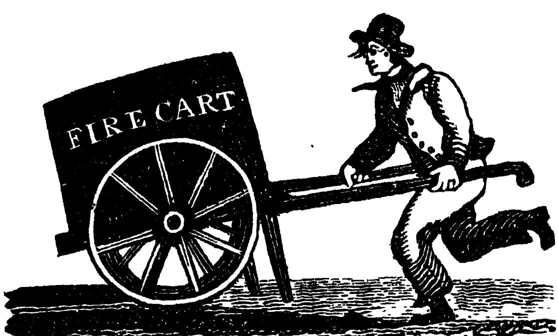


It must be obvious that the ready extinction of fire depends entirely on the facility with which water is brought to act upon it at its commencement; and that, when left uncontrolled during the delay of engines arriving, the procurement of water, and the further delay of getting the engines into full action, it reaches a height at which its reduction is highly doubtful, and at least very difficult. Many instances of destruction by fire have been caused by obstructions to the conveyance of engines to the spot, or from the impossibility of procuring water to enable them to act when they have arrived; and, in every case, some delay necessarily takes place in preparing the engines, even when water is at hand. It is a well-known fact, that many of the great and destructive fires in London and other large towns, where water-pipes are laid, might have been controlled, if water could have been obtained in time. In towns not so provided, villages, the detached residences of gentlemen, and other buildings in the country, the want of water at hand, or other means of extinction, makes their total destruction, in case of fire, almost inevitable.

From observations which I have made in witnessing fires, and from information of those persons constantly employed on such occasions, I am assured that a small quantity of water, well directed and early applied, will accomplish what, probably, no quantity would effect at a later period. This has excited my attempts to provide some prompt and efficient means by which the anxious and often important interval of delay wou'd be obviated, and the fire opposed on the first alarm; thereby not allowing the flames to increase in fury; which so often occurs, that the efforts of the fireman are exerted rather with the hope of preventing the extension of the calamity to other buildings, than to save that in which it first broke out.

To attain this object, I propose a Fire Cart of light construction, requiring but one person to convey it to the spot, and apply a fluid, in the most efficacious manner, from portable vessels or engines, on a principle very long known—the artificial fountain in pneumatics. The engines are to be kept always charged, and one, when slung across the body of a watchman or servant, is easily carried to any part of the building, however difficult of access. The management required is simple; for, on opening the stop-cock, the pressure of condensed air instantly propels a stream that can be directed with the most exact precision on the part in combustion,—a circumstance extremely important, when the incipient fire is not within the reach of effort by the hand, and when the air, heated by the flames, prevents approach to cast water upon it by common means.

Every fire, even the greatest, must arise from small beginnings, and when discovered in its infant and commencing state, is easily to be kept down and prevented from becoming destructive, if means of early application were at hand. We often hear of the alarm of fire given by watchmen long before the arrival of engines on the spot, and, if they were provided with a fire cart, the alarm of the watch and the application of the means of extinction would be simultaneous.



The cart contains six engines, each charged with the impregnated solution of an ingredient best adapted to extinguish fire. When the first engine has expended its store of antiphlogistic fluid, a supply of others in succession may keep up a constant discharge, until regular engines and plenty of assistance arrive, should the fire not be entirely subdued by these first efforts.

When a small quantity of simple water is cast on materials in a state of violent combustion, it evaporates into steam from the heat, and the materials thus extinguished readily ignite again; the addition of incombustible ingredients, consequently, becomes necessary to make quality supply the place of quantity, and thus with the smallest portion prevent the fire rekindling.

To give the most extinguishing properties to common water has engaged the experimental attention of many, in different countries,* and it has been rendered by them more effective to extinguish fire than forty times the same quantity of common water (a circumstance not speculative, but confirmed by trial made upon buildings erected for that purpose); but the simple ingredient of pearl ash dissolved in water, when applied on burning substances, forming an incrustation over the surface extinguished, and thereby preventing the access, has, in my estimation, a decided preference; it has likewise the superior recommendation of the readiness with which any person may imbue the water with it, while the compounds cannot be had but at considerable cost, nor be prepared without labour and nice accuracy in their respective proportions. Thus, at the moderate ratio of twenty times increasing the quality, the cart would convey an extinguishing fluid equal to one tun and a half of common water.

Specification in reference to the Apparatus belonging to the Fire Cart.

Each machine is a strong copper vessel, of a cylindrical form, two feet in length, and eight inches in diameter, capable of containing four gallons: a tube of the same metal, of one-fourth of an inch in diameter, curved so that its end is carried to the side of the vessel, with a stop-cock and jet-pipe, the vent of which is one-eighth of an inch in diameter at its top, reaches to within half an inch of the bottom, and is to be screwed so closely into the neck of the vessel as to preclude the possibility of the escape of the air.

Three gallons of water, holding in solution any ingredients* best adapted to extinguish fire, are to be put into the vessel, and then the room remaining for the fourth gallon to be filled with closely condensed air; to effect which, the jet-pipe is to be unscrewed, the condensing-syringe fixed in its place, and the air to be pumped in, to the utmost power of the strength of the vessel to contain it; the stop-cock is then to be closed, condensing-syringe taken off, and the jet-pipe replaced.

On turning back the stop-cock, the condensed air re-acts on the water, and casts it to a height proportioned to the degree of condensation.

That the machine may be more easily carried, where access is difficult, it is put into a leathern case with a strap, and, slung over the shoulders of the bearer, is thus conveyed easily, and then directed with the utmost precision to the point requiring the water.

As directions for the effective arrangement of fire carts in populous places, the following plan I should propose: That at each watch-house, from the time of the watch setting, there should be in attendance a regular fireman, instructed in the use and management of the apparatus; and that each parish should be provided with one or more fire carts, according to its extent or number of wards, and the vessels or engines composing the complement of the cart to be kept charged ready for being immediately applied. When watch-boxes or stations are at a considerable distance from the watch-house, some central watch-box should have a single engine lodged ready for application, to be brought on the alarm by the watchman, and delivered to the fireman, who repairs to the spot on the alarm of fire being given, with as much ex-

* 1734. M. Fuches, a German physician, by throwing balls into the fire, containing certain preparations, which burst with violence, instantly quenched the fire.

1761. Zachary Grey used the same process, in which were alum, sal ammoniac, and other saline matters, with water.

In the same year Dr. Godfrey, in a public exhibition in a house erected for that purpose near Mary-le-bone, applied the like ingredients with great success, by the action of confined gunpowder only, which, exploding, dispersed the solution on the materials in combustion, and effectively extinguished the same.

1792. M. Von Ahen, at Stockholm, made numerous public experiments to show the effects of several combined ingredients to render materials entirely incombustible; he is stated to have subdued an artificial fire by two men and forty measures of preparation, that would have required twenty men and 1500 of the same measures of simple water.

In the same year, M. Nil Moshein made many public exhibitions, to confirm that combustible materials might be made perfectly incombustible; as also did Mr. W. Knox, of Gottenburg.

* Pearl ash, dissolved in water, when applied on burning substances, forms an incrustation over the surface extinguished, and prevents that part from reinflaming.

pedition as possible. Should the fire have broke out near the depôt of the fire cart, the fireman in attendance will take the cart with him, or an engine from it ready to apply; if otherwise, the watchmen will each bring an engine, which the fireman will expend, and by receiving from others their engines, a regularly-continued and well-directed stream will be kept up, which, from the early opposition to the fire, will no doubt check the flames, if not entirely subdue the fire; should the distance be considerable, the fireman, aided by a watchman, would convey the cart to a place on fire with as much dispatch as possible.

Letter from the Hon Capt. Pellew, R.N. to Captain Manby.

"London, June 27, 1816.

"MY DEAR SIR,—Having been one of those who witnessed, with much satisfaction, the trial of your newly-invented machine for the extinction of fire in its earliest stages, I cannot refrain from relating to you, that, in the late fire close to my house, and which I myself discovered, if I had had one of the machines at my immediate command, I do not hesitate to say, I could have saved the whole premises and an uninsured property of nearly 12,000l. I can venture to assert this fact, because it came under my own inspection; I therefore cannot be deceived. The fire, when I first saw it, was just caught, and I conceive was quite extinguishable by your machine for at least twenty minutes.

"I may also here give my opinion as a naval man, as to its great use, in my opinion, on board ships, in case of fire below, where water is not easily conveyed. I shall never go to sea again without one of them for the use of the store-rooms, &c. Upon the whole, I do declare to you, it is, in my opinion, one of the best inventions I ever saw; and wishing you every success in the prosecution of your generous plans,

"I am, Sir, yours, &c.

"P. B. PELLEW."

BROWN'S GAS ENGINE

SIR,—Mr. Brown's contrivance is not new. There is, at present, in Mr. Leslie's Class-room, College of Edinburgh, a machine constructed upon the very same principles; the *primum mobile* being an oil lamp, which rarefies the air, thus forming a kind of vacuum under a piston, from which the power proceeds *This is an incontrovertible fact, for I have seen the machine in full action.* It moves with prodigious velocity, so long as the cylinder, in which the piston acts, is cool; but as soon as it becomes heated, the process of the machine is greatly retarded.

This is not the first time that ingenious men have been found asserting their contrivances to be new inventions. The late Mr. Bramah went into the same mistake, when he pronounced his hydraulic press to be a new mechanic power. J. Y.

CLOCK-MAKING.

SIR,—In perusing your 48th Number of the "Mechanics' Magazine," page 315, I observed some remarks by Mr. James Collins, on Dr. Franklin and Mr. James Ferguson's three-wheel clocks, with his own improvement. I perfectly agree with Mr. Collins in his objections, but see further room for improvement in Mr. Ferguson's, than what Mr. Collins has pointed out. In 1817, I made one with three wheels inside, but added two under the dial, to carry the hands direct; that is, the hour and minute hands only. It goes eight days, with a fall of twenty-one inches, and goes as correct as it is possible for any plain timepiece to do. In 1820, I made another with three wheels only. The hands are fixed on their own centres or axes, and go direct, but require to be set right separately. This clock goes eight days, with a fall of twenty-one inches.

I am, Sir, &c.

Newcastle-upon-Tyne. G. S.

[A more detailed description of our Correspondent's Clocks would be acceptable.—ED.]

FRUIT-GATHERER.

SIR,—A year or two ago, as I passed through the town of Carlsruhe in Germany, I saw a machine for gathering fruit from the pendent branches of trees incapable of supporting a ladder, and out of the reach of the hand, which struck me as being both simple and well adapted to the purpose. Should it be considered so by you, and as worth the insertion in your valuable Magazine,

the enclosed sketch of it is at your service. The season for putting it in use is now at hand, and possibly it may be turned to some effect by one or other of your numerous readers. The construction of it is this: A piece of flat, light board, about eight inches over, and, if you please, somewhat more in length, of either a round or an oval form, has a row of holes bored all round it near its edge, taking the shape of the board, and about the diameter of a quarter of an inch, into which are driven tight as many pegs, about six inches in length, which pegs are then bound together by a neat platting or banding of basket-work, about the breadth of a third of the height of the pegs, and worked down close to the bottom of the board. The part of the pegs above the wicker-work is to be cut "tooth fashion," for being applied to the stalk, between the fruit and the bearing spur of the tree, and by a wring of the machine, to draw it off into its interior. This head, if I may so express it, is attached to a light pole, of any convenient length for the purpose. The only improvement I would suggest is, that the bottom should be, in a great measure, cut out, and supplied by a coarse netted bag, which might remedy the chance of the fruit's rolling out, or of its getting bruised by falling on the board. It is possible that this contrivance may be in use in the apple districts of this country, but I have never met with it.

Yours, with much respect,

Sept. 15, 1824. SUFFOLKIENSIS.

MACHINE FOR RAISING STONES.

SIR,—"Northumbriensis," p. 152, vol. II. may find an interesting description of the machine invented by Mr. Richardson, of Keswick, for raising stones, in the 8th Number of the Edinburgh Philosophical Journal, in which the firm retention of the cylindrical plug is satisfactorily attributed to the elastic power of the stone. I have seen four or five men, with a common triangle, and double and single block tackle (without a roller and levers), raise a stone of nearly two tons weight, although the plug was not driven into the hole more than three-quarters of an inch. I apprehend, that the inferior elasticity of Portland and other soft stones would render the application of the machine uncertain in its effect, and extremely hazardous.

I am, Sir, &c.

Bridport. E. N.

CORRESPONDENCE.

Postage of Letters.—Having received numerous intimations, that, among workmen whose means are limited, the condition of *post-paying* their letters prevents many communications of value from being sent to us; and being anxiously desirous of encouraging the correspondence of this valuable class of individuals, we recommend to them, in all cases where a little delay is of little consequence, to entrust their letters to the bookseller by whom they are supplied with our Magazine, who will readily forward them, free of expense, by his first parcel to London.

Burch on Gunter's Lines has been anticipated by Monad, p. 412, vol. II. and Mr. Pickett, p. 14, vol. III.; except as to the use of the Sliding Rule, to which we shall shortly devote a few pages.

We shall be glad to hear again from Mr. T. S. D. of Bath.

G. A. S. is requested to send to our publishers' on Monday next, for a letter addressed to him.

A Correspondent wishes to know where the Dandy Loom, described in p. 45, vol. I. can be procured?

Suffolkiensis.—We have been disappointed of the Engraving which should have accompanied his communication, and have thought it better to give it without any, rather than make its insertion a week longer *out of season*. The description, besides, is of itself sufficiently plain.

J. W. A. may continue to address as he did his last.

Communications received from E. Nicholetts—J. M'Vey—J. J. Dartford—E. N.—Guillot, of Portsea—P. Vauryde—A Minor—Jas. Parry—Anonymous.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-row, London.

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Mechanics' Magazine,

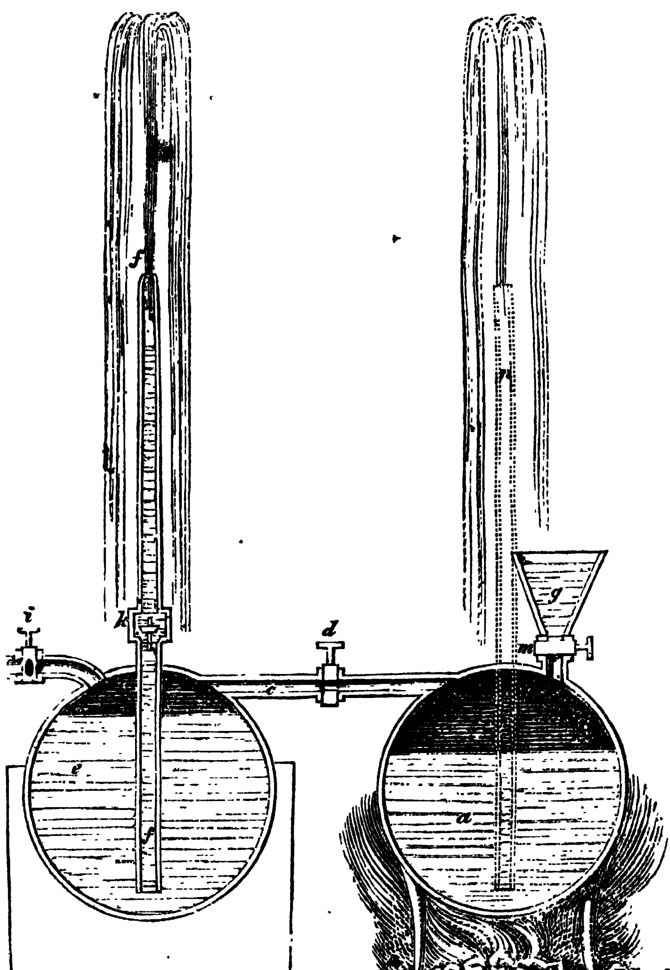
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

"The most valuable gift which the Hand of Science has ever yet offered to the Artisan." *Dr. Birkbeck.*

No. 59.] SATURDAY, OCTOBER 9, 1824. [Price 3*d.*

"Theoretical and practical men will most effectually promote their mutual interests, not by affecting to despise each other, but by blending their efforts; and an essential service will be done to mechanical science, by endeavouring to make all the scattered rays of light they have separately thrown upon this region of human knowledge converge to one point."—*Dr. Olinthus Gregory.*

LORD WORCESTER'S STEAM-ENGINE.



ILLUSTRATIONS OF THE MARQUIS OF WORCESTER'S CENTURY OF INVENTIONS.

No. 4. The sort of cipher here referred to was the subject of much conjectural speculation (see Gent.'s Mag, vol. xviii. p. 55) till the ingenious writer of the article Cipher, in Rees's Cyclopædia, discovered, among the Harleian MSS., a paper in the hand-writing of the Marquis of Worcester, which is supposed to contain a full specification of the invention. It is entitled "An Explanation of the most exact and most compendious Way of Short Writing; and an Example, given by way of Questions and Resolves upon each significant Point, proving how and why it stands for such and such a Letter, in order alphabetically placed in every page." His method of writing may be thus explained: an engraved page is given to write upon, in which are made horizontal rows of octangular squares or chequers; and a straight line is to be drawn from the centre towards the circumference of these squares, in different positions and of various lengths, for each letter of the alphabet. Thus, A is a short horizontal stroke made to the right hand, and not touching the circumference; I is the same stroke, passing close to the circumference; R is the same stroke, going beyond the circumference; E, N, and W, are represented by a similar stroke in the opposite direction, but varying in their lengths. By a like method, he suggests that we may write with a dot, or single point only; which is to be placed at a certain distance, and in a certain direction, from the centre of the octagon, for each letter of the alphabet. The Marquis proposes this contrivance for the purpose of writing with secrecy as well as with brevity, and leaves it to the will of any person to change the value or name of the letters as may suit his fancy or intention.—Vide Rees's Cyclopædia, article Cipher; where a specimen of the Marquis's invention is given.

No. 6. Does not this suggest the idea of the telegraph for conveying dispatches over great distances in a short time? and

No. 7. The universal telegraph, for day and night signals, invented by Lieutenant-Colonel Pasley, of the Royal Engineers?—S. R.

Nos. 9, 10, and 11, point evidently to the invention of the torpedo.—The following account of its application, in modern times, is taken from the "National Register," English newspaper, of the 12th September, 1813. The invention is American, and the account also American. It may, perhaps, be in the recollection of some of your readers, that, some little time previous to the event here recorded, a similar attack was made on his Majesty's ship Ramilies, and that, after two or three unsuccessful attempts, the Americans succeeded in attaching the machine, which, as soon as the operator had taken his departure, blew up with tremendous force. The effect produced was the destruction of almost the whole fore-part of the ship, part of the cutwater being carried away. The tide was then very unfavourable to the attempt, and prevented the machine being fixed so as to do more mischief. I speak of this, however, from recollection only.

"Norfolk, July 27th.

"Mr. E. Mix, of the navy, a gentleman of integrity and enterprise, has been for several weeks preparing torpedoes to attempt the explosion of the enemy's shipping in Lynn Haven Bay. The British 74-gun ship, Plantagénet, that has for a month past been lying abreast of Cape Henry light-house, and has rarely had the company of any other vessel, appeared to Mr. Mix as the most favourable object for trying his experiment on Accordingly, on the night of the 16th of July, accompanied by Capt. Bowman, of the Salem, and Midshipman M'Gowan, of the United States navy, who volunteered their assistance during the whole enterprise, he left his place of rendezvous, and proceeded down to the Plantagenet, of 74 guns, in a large open boat, which he calls the 'Chesapeake's Revenge,' and, from previous observations, found no difficulty in ascertaining the position of the ship. When he had got within forty fathoms of her, he dropped the torpedo over, in the very instant of doing which he was hailed by one of the enemy's guard-boats; the machine was speedily taken into the boat again, and he made his way off in safety. On the night of the 19th he made another attempt, and was again discovered ere he could accomplish his purpose. On

the night of the 20th he succeeded in getting within fifteen yards of the ship's bow and directly under her jib-boom: there he continued making his preparations for fifteen minutes, when a centinel from the forecastle hailed, 'Boat, ahoy!' and he had to decamp. The centinel not being answered, fired his musket, which was followed by a rapid discharge of small arms. Blue lights were made to find out the boat, but failed; they then threw rockets in different directions, which illuminated the water for a considerable width as far as they were thrown, and succeeded in discovering the position of the nocturnal visitor, when the ship commenced a rapid fire of heavy guns, slipped her cables, and made some sail, while her boats were sent in pursuit: the daring intruders, however, escaped unhurt. The visits were repeated on the nights of the 21st, 22d, and 23d, without success, as the ship, having taken alarm, changed her position every night. On the night of the 24th, however, Mr. Mix succeeded in finding her out, and having taken his position, within 100 yards distant, in a direction with her larboard bow, he dropped the fatal machine into the water, just as the centinel was crying 'all's well.' It was swept along by the tide, and would have completely effected its errand but for a cause not to be named here, but which may easily be guarded against in future experiments—it exploded a few minutes too soon. The scene was awfully sublime; it was like the concussion of an earthquake, attended with a sound louder and more terrific than the heaviest peal of thunder. A pyramid of water, fifty feet in circumference, was thrown up to the height of thirty or forty feet; its appearance was a vivid red, tinged at the sides with a beautiful purple. On ascending to its greatest height it burst at the top with a tremendous explosion, and fell in torrents on the deck of the ship, which rolled into the yawning chasm below, and nearly upset. Impervious darkness again prevailed. The light occasioned by the explosion, though fleeting, enabled Mr. Mix and his companions to discover that the fore-channel of the ship was blown off, and a boat, with several men in her, which lay alongside, was thrown up in the dreadful convulsion of the water. Terrible indeed must have been the panic of the ship's crew, from the noise and confusion which appeared to our adventurers to prevail on board, and they are certain that nearly the whole of the ship's crew hastily betook themselves to the boats."—S. R.

No. 15. In No. 11 of the "Mechanics' Magazine," a drawing is given of a boat moved by wheels; and in No. 13 there is a letter signed A. B., suggesting that some machinery on a similar principle might be applied with advantage to barges navigating the River Thames. I have myself seen some drawings of an invention whereby vessels, as I am informed, may be propelled by *very easy* manual labour, at the rate of four to seven miles an hour, on such streams as the Thames. The inventor tells me that he can, in the course of a little while, make the machine do its own work with only the assistance of a man to look at it occasionally. It will be asked why does he not make it public, and give it a fair trial? The answer is—the man is poor, and those who have the means of putting his invention to the test, when they have been spoken to, have laughed at it as chimerical.—If A. B. has the means and feels inclined, after reading this, to assist the man, the writer of this will, on A. B. leaving his name and address at your publishers', exchange the address of the person alluded to.

In the "Hampshire Telegraph," of September, 1823, it was announced that Sir J. Cox Hippisley was making experiments at Cowes, Isle of Wight, with a large boat, which was impelled through the water, at the rate of ten miles an hour, by means of six paddle-wheels, which moved by a handwinch. Also, within the last four months, it has been noticed in the daily papers, that a boat is now in use, on the rapids in America, for conveying goods, &c., which is forced up the stream by the stream itself putting in motion paddles affixed to the sides of the boat.* This invention answers to the same purpose as what is called, in the navy, *warping*.—S. R.

No. 19. I believe Ackermann's patent axle-tree has a contrivance, by means whereof, if a carriage is run away with by the horses, it may be disengaged from them and stopped immediately, without fear of overturning.—S. R.

No. 28. No European armies are, at the present day, sent on campaigns

* The same invention, we presume, which was *first* noticed and described in this country in our own pages. See pp. 67, 68 vol. I.—EDIT.

without pontoons forming part of their *materiel*. They are found very serviceable for fording small rivers; and I should suppose that they come as near to the Marquis's invention as any thing which has been used for such purposes. The pontoons are large flat-bottomed boats, which are carried by horse and cart; they are so well known to every private soldier, and to your readers, as to render any minute description needless. The English armies use tin in their manufacture—the French armies employ copper; and there is this advantage derived from the latter, that when by long use they are rendered unfit for further service, the copper will always sell for something; but the tin, when once worn out, is of no further use or advantage in any way whatever.—S. R.

Nos. 58, 59, 60, 61. Repeating guns have been invented in America, containing from five to twelve charges each, which may be discharged, in less than two seconds to a discharge, with the same accuracy and force as the ordinary fire-arms. The number of charges may be extended to twenty, or even forty, if required, without adding any thing to the encumbrance of the piece. The principle applies equally well to muskets, rifles, fowling-pieces, and pistols. These guns possess all the advantage of the ordinary fire-arms, for loading and firing single charges, with the additional advantage of priming themselves, and keeping in reserve any number of charges that may be required to meet any emergency; which charges are as completely under the distinct and separate control of the gunner, as a single charge in the ordinary gun. The "Monthly Magazine" humanely wishes, in noticing this invention, that the patriots of Greece had a monopoly of them..

Now I am upon the subject of guns, I cannot help noticing that excellent improvement upon the art of shooting, in the using of percussion-guns. A Correspondent, in No. 18, p. 280, speaks very highly of a gun he used, made by one Wightman, and he gives a drawing of it. Had that gentleman seen the lock and breech invented by Mr. Beckwith, of Skinner-street, and applied by him to double and single barrelled guns, I think he would not have praised up Wightman's so much. My objection to Wightman's is, that, as described, it appears too complex, is liable to be easily put out of order, and will require a degree of skill to repair it beyond what ordinary gun-smiths possess.

One of the advantages I have found in shooting with Mr. Beckwith's gun is this, that when the powder, as will sometimes happen, however cautious you may be, clogs the chamber of the piece, and is apt to make it miss fire, let the pan or nipple be unscrewed, the entrance to the chamber cleared with a picker, and the perforation of the nipple or pan cleared also; then put in some dry powder to the chamber, and some into the perforation of the nipple, &c. and screw it in again, prime it, and it *must* go off, by reason of the accession of new powder. Should it be objected, that the gun is thus rendered liable to burst, I say, the quantity of fresh powder need not cover a half-crown; and if you are *afraid*, prop your gun in the hedge, and pull the trigger with a string. Another advantage is, that the line of fire connecting the priming of the chamber is so DIRECT and instantaneous, that the cross action of a flint-lock gives a gun upon the old principle the appearance of hanging fire.—S.R.

No. 68, as also Nos. 98 and 100, are those on which the Marquis of Worcester's claim to the invention of the steam-engine are founded. In our last, we gave an engraving of an engine, such as Professor Millington and Mr. Stuart conceive might answer the description given by the Marquis; and of this ideal sketch, we now quote the following explanatory particulars from Mr. Stuart's valuable work:—

"The two spherical vessels, *a o*, in the figure, have two pipes, *d f*, proceeding from them, and inserted into a boiler, *g*. These pipes have two stop-cocks, *z*, *w*, which shut off the communication between the boiler and the vessels. From another part of the vessels proceed two other pipes, having valves at *s x*, opening outwards, and terminating in a single pipe, *e*. The spherical vessels have each

another valve opening inwards, and a very short pipe, *n v*; the pipe, *n e*, rises forty feet, and terminates in the reservoir, *u*; *b* is a section of the fire-grate, under the boiler, *e*; *t*, the door of the fire-place; *l*, the brickwork; *g*, the ash-pit; and *h* is a reservoir of water in which the vessels, *o a*, are placed, and which is to be returned into the cistern, *u*. If we now suppose a sufficient quantity of steam to be generated in the boiler, *e*, from the water, *g*, and the stop-cock, *z*, opened so as to allow a free communication between the boiler and the vessels in the reservoir, the steam will descend into the pipe, *d* (the pipes and vessels being made or cased with some material to prevent the condensation of the steam by the water in the reservoir into the vessel *a*), and will expel all the water or air which it may contain through the valve, *s*, into the pipe, *e*, which will deliver it into the reservoir, *u*. The cock, *z*, is now to be shut, and the valve, *v*, being freed from the pressure of the elastic vapour, will be forced inwards by the gravity of the water in the reservoir, which will speedily fill the vessel, *a*. But when the cock, *z*, is shut, the opposite one, *w*, is opened, and the steam from the boiler raises the water which may be contained in *o* up the pipe, *e*, closing, in this operation, the valve, *s*. When the vessel, *o*, is filled with steam, the cock, *w*, is shut, and the water in the reservoir rushes into *o*, as it did into *a*, and fills it. The cock, *z*, is now opened, and the steam again expels the water from the vessel, *a*, and so on successively, so long as steam is produced in the boiler, and the cocks, *z a*, are opened and shut alternately.

"Mr. Millington remarks that this engine agrees, so far, with the Marquis of Worcester's description, where he says that 'a man has but to turn two cocks, and that one vessel of water being consumed, another begins to force and refill.' He also observes that the condensation of the steam opens and shuts the valves, and fills the vessels; but that this use of the vacuum is part of an invention to which the Marquis has no claim, his Lordship expressly stating, 'that the water *is not* raised by drawing or sucking it upwards.' The 'force and refill,' in the original account, would almost lead to a supposition that these operations were going on at the same moment in the same vessel. The arrangement of pipes, and cocks, and valves, is also gratuitous.

"The 'admirable method of drawing up water by fire,' appears to have been the favourite project of the noble inventor; for he afterwards devoted a separate book to an enumeration of its extraordinary uses and powers, under the title of an 'Exact and True Definition of the most stupendous Water-commanding Engine, invented by the Right Honourable (and deservedly to be praised and admired) Edward Somerset, Lord Marquis of Worcester, and by his Lordship himself presented to his most Excellent Majesty Charles the Second, our most gracious Sovereign.' This 'Exact and True Definition' is a quarto pamphlet of twenty-two pages; but, instead of *a definition*, it contains only an enumeration of the *marvellous uses* of his invention, as vaguely and strangely written as those in the 'Century of Inventions.' The rest of the pamphlet is filled up with an Act of Parliament, allowing him the monopoly of such an engine, and reserving the tenth part of the profits to the king, with four wretched verses of *his own*, in commendation of his invention; with the '*Exegi monumentum*' of Horace, and the '*Barbara Pyramidam sileat*' of Martial. Some Latin and English verses, panegyrizing the noble inventor, written by James Rollock, an old dependant of his Lordship, complete the volume."

Mr. Stuart afterwards gives another design of an engine, which, in his opinion, approaches still nearer to the description of the Marquis than that which we have just been considering.

"From the opinion we have expressed," says Mr. Stuart, "of its being practically impossible to produce an apparatus fulfilling *all* the conditions of the description in the 'Century of Inventions,' without introducing parts which are unquestionably due to the inventive genius of other mechanics, it is with great diffidence we propose the apparatus represented in the second figure, as being nearer to the description than that shown in the first figure, in so far as *not using the pressure of the atmosphere*, which the Marquis states *a principle of his engine*.

"But, after all, it is impossible to decide from Lord Worcester's description whether *two boilers* are meant, and one *receiving vessel*, or *two vessels* and *one boiler*, or only two vessels, like Da Caus's, probably having each an eduction pipe and the proper cocks to produce a continuity in the stream of water, as in the figure prefixed to the present Illustrations, where the dotted lines rising from the vessel *a* would then represent this pipe, the fire being made under each boiler alternately. And where mention is made of one vessel of water, rarefied by fire, driving up forty of cold water, should not this be understood as the proportion of water which would be converted into steam, in order to raise the remaining portion in the *same vessel* forty feet high? An apparatus designed on this supposition would satisfy the description nearer than any.

"Having so wide a choice, we will give the Marquis credit for an apparatus for generating the steam in a separate boiler: *a* will, therefore, be that boiler; *c*, a pipe (having a stop-cock, *d*) connecting the boiler with the cold-vessel water, *e*, from which proceeds the eduction pipe, *f*; *g*, a pipe and funnel, to supply the boiler with water; *h*, a similar pipe-cock, to supply the vessel, *e*, with cold water, connected with a cistern from which the water is to be raised; *i* is a stop-cock to this pipe; *k*, a valve to prevent the return of the water which may be in the upper part of the pipe, *f*.

"When the steam in the boiler, *a*, is allowed to enter the cold-water vessel, *e*, by turning the cock, *d*, the water is raised in a jet through *f*, until the vessel, *e*, is emptied. When this is the case, the cock, *d*, is shut, and *i* is opened, and the vessel, *e*, is again filled with cold water. The cock, *i*, is then shut, and the stop-cock, *d*, is opened; and the steam from the boiler, pressing on the surface of the water in *e*, forces it up the pipe, *f*. When this is emptied, the same operation is repeated, and so on successively; so that the condition of the alternate opening and shutting *two cocks* is fulfilled, also the forcing and refilling of the vessels; and one vessel of water rarefied by fire would elevate double the quantity of that stated by the Marquis."

(*To be continued.*)

REPORT OF A COMMITTEE OF THE AMERICAN CONGRESS ON HIGH PRESSURE STEAM ENGINES.

(*Continued from page 27.*)

Further, to corroborate the opinion of your Committee on the superior safety of low pressure engines, they subjoin part of a Report made by a Committee of the City Council of Philadelphia, raised to inquire what regulations were necessary to produce the safety of passengers in steam-boats. That Committee consulted scientific men of eminence: Professor Cooper, Mr. Graff, and Mr. Jacob Perkins; and obtained from them the following detailed opinions:

To Thomas Cooper, Joseph Cloud, Jacob Perkins, and Frederic Graff, Esqrs.

I am directed, by the Joint Committee of the Select and Common Councils of the City of Philadelphia, appointed on the subject of Steam Boats, to submit the following questions for your consideration, and request the favour of answers as early as they can be furnished consistently with your convenience.

Very respectfully,

ROBERTS VAUX, Chairman, &c. &c.

Philadelphia, 7th mo. (July) 3, 1817.

1st. Whether what is commonly called high pressure engine is, in your opinion, proper for a passage boat? whether, with the precaution of proving the boiler once a month, and a double safety valve, as proposed by you, will render them perfectly safe? whether, in case of an explosion, when the steam is at the ordinary pressure at which such engines are worked, it would not, probably, be fatal to the lives of most of the persons on board?

2nd. Whether an engine that works with a pressure of from seven to ten pounds to the square inch, would, in case of explosion, probably do any injury, except to persons who were immediately adjacent to the boiler, or who were not separated from it by a partition? and whether the common partition in use in boats navigated by low pressure, and the distance at which passengers on deck or in the cabin are from it, does not make them safe?

3rd. Whether, to your knowledge, boilers on the low pressure plan have not frequently burst, without any injury whatever to the passengers; and if any case to the contrary exists, what are the particulars of it? What experience have you on the subject of explosions of high pressure engines, and the consequences?

To Roberts Vaux, Esq., Chairman of a Joint Committee of the Select and Common Councils of the City of Philadelphia.

SIR,—In reply to the further questions proposed by the Committee, the undersigned states, as his opinion,

1st. That, whatever be the construction of a steam engine on board a boat, the precautions already recommended in a former report to the Committee, are *indispensable* to the perfect safety of the passengers.

2nd. Although with due precautions and continual care, the danger arising from engines working with high pressure, may be reduced, so as to render them as little liable to explosion as the engines that work with a low pressure, yet accidents must be calculated upon to happen to engines of all and every construction at one time or other. *In such cases the danger will be far greater from engines worked with steam of high pressure, than with the common engines of Bolton and Watt, or Fulton.* Even in cases where the danger arising from an accident is trifling, the noise and the vapour that issue from a very small opening in the boiler or other parts of a high pressure engine, are so much more alarming to persons ignorant of the cause, than when a similar accident happens in an engine of low pressure, that the chance of this happening well deserves to be taken into the account: for the fright and the alarm may have serious consequences, even when there is no other real danger.

3rd. Every engine working with steam beyond ten pounds upon the square inch, ought to be considered as a high pressure engine.

4th. Under present circumstances, it seems expedient to give a decided preference to engines in steam boats where the pressure is below ten pounds on the square inch, for even that pressure is unnecessary, and may and ought to be avoided.

5th. With respect to the explosions and accidents that have happened on board steam boats, in this country and in England, the statements have been too loose and general to afford any foundation for an accurate and decided opinion; but enough has been published to show that these accidents have happened from rashness or negligence, by means of which the steam valve has been overloaded, or by using machinery ill made or too much worn. A steam engine on the construction of Bolton and Watt may rashly or negligently be loaded with fifty pounds instead of five pounds; but it is manifest that steam pressed with twenty pounds, for instance, cannot possibly do so much damage as steam pressed with two hundred pounds on the square inch. In the latter case it would act nearly with the force of gunpowder, as there is good reason to believe it has often done.

6th. As, in all civilized countries, passengers are under the protection of the law, and ferries and carriers, whether by land or water, are objects of legislative control, this subject seems to the undersigned proper to be submitted to the consideration of the legislature.

THOMAS COOPER.

July 7th, 1817.

SIR,—In answer to your inquiries respecting high pressure engines, and those on the Bolton and Watts principle, with steam from seven to ten pounds, on board of passage-boats, I submit my opinion, without any other motive than that for the safety of the lives of those who travel by that convenient mode.

1st. As respects high pressure engines, I am of opinion, that if the precautions recommended in a former Report are rigidly enforced, perhaps explosions would not take place; but presuming that, with all the care of those appointed to make a monthly survey, some part of the work might be overlooked, from hurrying the examination, in order to have the boat ready for the succeeding trip; this induces me to believe, that it is probable fatal accidents may occur, and many lives be lost, if an explosion should take place.

2nd. An engine that is worked with the pressure of from seven to ten pounds to the square inch, with a boiler reasonably strong, there can be little danger of an explosion; but should an explosion take place, I am persuaded that the danger to passengers in the cabin or on deck would be trifling, provided the partitions and deck between the boiler and the cabin are sufficiently strengthened, *and the doors, if admitted at all*, are hung in such a way, that by the concussion occasioned by the explosion, they would fly shut. I would recommend an additional passage from the cabin to the deck in the after part of each boat, that, in case of accidents, a more ready passage would be at hand, without being obliged to pass out near the boiler, as is now the case in most of the steam-boats on the Delaware.

3rd. The only burst which has come to my knowledge in working low pressure steam, happened with one of the boilers at the lower engine of the Philadelphia water-works, occasioned by the heads of the bolts burning off over the fire-place, and the joints parting; the workmen received no injury, as the fire-doors were shut—the boiling water passed into the ash-pit.

From the information I have obtained, it appears that every accident that has occurred was occasioned by high pressure steam, applied either in engines adapted for working high steam, or those of Bolton and Watt, which were never intended by the inventors to carry more than six pounds in the extreme. As the Bolton and Watt engines are now worked with from ten to twenty pounds pressure, I conceive the danger of explosion nearly as great as with those working at a pressure of 150 pounds to the square inch, and in some instances greater, where the construction of the boiler is not adapted to carry more than from seven to ten pounds with safety.

I am, with great respect, your obedient humble servant, FRED. GRAFF.

Philadelphia, July 9, 1817.

Roberts Vaux, Esq. Chairman, &c.

Philadelphia, July 8, 1817.

SIR,—In reply to the further questions proposed by the Committee, the undersigned is of opinion,

1st That all engines worked with a pressure above from five to seven pounds the square inch are unsafe, unless the precautions already recommended in a former Report to a Committee are adopted. That the engines which work with a pressure of seven pounds and below need only a second safety valve, without the proof; for, should an explosion take place, experience shows that the passengers would be perfectly safe. There is no doubt, that in case of an explosion, the higher the steam, the greater the danger; but engines may be so constructed, that there would be no danger, even with a pressure of 150 pounds to the inch. Boilers may be made to withstand the pressure of 600 pound to the inch,

and, if proved often enough to detect any defect occasioned by corrosion or otherwise, it would seem that no explosion could possibly take place.

2nd. If boilers were made so weak as to be *sure* of bursting at a pressure of seven pounds or below, there would be little or no danger from such explosions; but boilers have many modifications; some will burst at the low pressure of four pounds, when others will not burst at 300 pounds. The boilers that are constructed to bear the pressure of 20 to 50 or 60 pounds, the undersigned is of opinion, are the most dangerous, since it is more easy to get the steam up to that height, than to raise it from 150 to 300 pounds.

3rd. As far as the knowledge of the undersigned extends, all explosions that have taken place, where the engines have been worked at seven pounds and below, have done no injury to the passengers. It is the boilers that have been made to bear a higher pressure than seven pounds to the inch which have proved so fatal; but had the owners known their strength, and been provided with safety valves, properly adjusted, no explosion could have taken place; unless they had been constructed like the two on the Mississippi which have produced such disastrous consequences. This form of boilers should certainly be abandoned; no safety valve, nor any precaution, would make them secure. These boilers are cylindrical, and have flues passing through their centre.

The misfortune has not happened by the bursting of the boilers, but has been occasioned by the flue, where the fire is built, being heated to such a degree, when the water has been suffered to get too low, as to collapse, and make an opening for the steam and water to rush out. This was the case with the Washington and the Constitution. At the Pittsburgh nail factory, where Evans's most improved boilers had been used for a number of years,* it was apprehended it was time to replace them; and while new boilers were making, one exploded while the steam was at sixty pounds. When examined, it was found that a piece was blown out at the top, about four by six inches. It removed a few bricks, but occasioned no mischief. It was found that the thickness of the iron was reduced, by corrosion, to less than one-sixteenth † of an inch, at the spot where the explosion took place. The undersigned has not been informed particularly as to the other disastrous explosions; but he believes several have taken place as low as twelve or fifteen pounds pressure, and that such ought to be considered as high pressure engines. Yours, respectfully,

JACOB PERKINS.

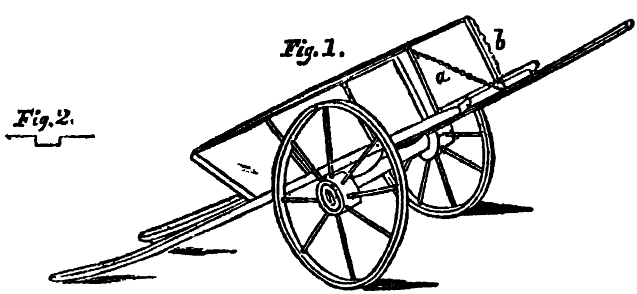
Roberts Vaux, Esq. Chairman, &c.

The opinions of such men carry with them great weight; and it is believed, that the precautions recommended by them are the same as those proposed by your Committee. The committee, therefore, report a Bill.

* This rapid corrosion was occasioned by the use of mineral water; since river water has been used, no event has taken place.

† When new it was five-sixteenths.

METHOD OF RAISING FALLEN CARRIAGES.



SIR,—A premium has been held out by the Society of Arts for several years past, for preventing the falling of horses with two-wheeled carriages. Now, as it is not in my power (nor, I believe, in the power of any one,) to prevent their falling, I propose the following method of raising them when fallen :—

Suppose the body of the cart to be six feet long, and that there is space enough (as there generally is) between it and the axletree to admit a piece of wood of the same length

(six feet), and about four inches thick, made to slide through a strong staple (Fig. 2.), bolted underneath the tail of the cart. Now, as the cart itself is a lever, the fulcrum of which is the axletree, it is easy to conceive that, when the additional lever is drawn out, and the weight of four or five men applied to it, the power gained will instantly release the poor suffering animal from its painful situation. I should think that half a minute would be quite sufficient time for the whole operation.

Your Subscriber, E. W.

P.S. The two chains, *a* and *b*, may be fastened to the sides of the cart, and hooked on to the lever for additional strength.

WOOL-COMBING STEAM CHEST—PLAN FOR A PUMP WANTED.

Fig. 1.

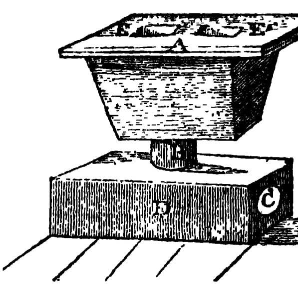


Fig. 2.

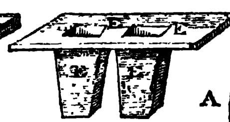
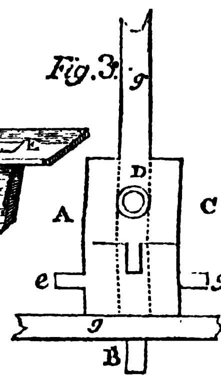


Fig. 3.



Sir,—In No. 46, you have given an account of a Steam Soldering Machine, which induces me to send you a short description of a Wool Combing Steam Chest, for heating the combs by steam instead of charcoal. The invention has now been about nine years in use. I know of one room in which there are about twenty-six of those steam chests at work, supplied from one steam boiler. The "Goldsmith's Apprentice" states, that tin is not strong enough, and that copper or brass must be employed. On this point it may be proper to state what the experience of the inventor of the combing chest has been. He first had a box made of tin, and fixed to the steam that supplies the works; but the steam melted the solder that the chest was put together with. He then tried copper and hard solder, but they met with the same fate. Foiled in these two experiments, he got a cast iron chest made, when he found it to answer completely.

Description of the Engravings.

Fig. 1 is the steam-chest; Fig. 2 exhibits a clearer view of the inside, which is cast in separate parts, and put together with screws and cement, as shown at the part A in Fig. 1. B is the pipe that connects the chest with the main steam pipe; C is the main steam pipe; D, the wooden casing that covers the main steam pipe that runs along the room floor, and keeps down the heat from the men at work; E E are the places where the combs are heated; F shows that the top projects a good way over, to give more room for the wool to lie on when the men are working it.—This plan is found to answer well for fine wool.

I remain, Sir,
The North Star.

Sir,—I shall be obliged to any of your readers who will assist me with a plan for a Pump, which I wish to serve three different apartments. It must be fixed in a party-wall. I shall have no objection to two levers to the spear-rod, and it should be so contrived that A B and C (Fig. 3, in this page) may be able to work without going into each other's apart-

ments; and that the water will only run out at the spout going into the apartment of that person who pumps. Suppose A B and C to be three different apartments; D, the pump; g, the walls; E F and G the three spouts to supply the rooms A B and C with water. The query is, How to make it only run out at the spout of the person who pumps? I presume the working of the pump is easy, but turning the water three ways is the great point.

Lancaster. M. S.

POISONOUS NATURE OF AFRICAN TIMBER.

We were the first to state, several weeks ago, on the authority of a respectable Correspondent (p. 236, vol. II.), that splinters of African oak, when run into the flesh, were of so poisonous a nature as to cause death; and we recommended at the time, that a chemical analysis of the wood should be immediately instituted, in order that the fact might be placed beyond doubt, and care taken (we alluded to our dock-yards particularly) that no more lives should be lost by working on this material. The warning found its way into all the newspapers (though without acknowledgment of the source from which it was derived), but still without exciting that medical attention to the subject which it seemed to us so imperiously to call for. Of the consequences of this neglect, the following paragraph in "Flindell's Western Luminary" furnishes a melancholy illustration. We trust that an inquiry into the subject, by the competent authorities, will no longer be deferred.

"In the course of the last fortnight, seven shipwrights and two sawyers, of Plymouth-yard, have died. All these men had received cuts or bruises, while employed on African teak-wood; and though some have attributed the deaths to atmospherical influence, there are not a few who assign them to the reception of poisonous juices of the above-named timber Of these men, a shipwright, Gregory Nichols, a remarkably powerful and active man, scratched his leg against a piece of the wood, and mortification ensued almost immediately. To ascertain the probable cause, Dr. Bell, surgeon, opened the body, and, in the course of dissection, happened to scratch one of his fingers. This passed unnoticed at the time; but, in the afternoon, Dr. Bell became alarmed at perceiving it, thinking he might have imbibed some of the morbid matter; shortly afterwards a shivering came on, and he was obliged to be put to bed and bled. The best medical aid was administered, and the most rigid attention paid to his case; but, in spite of all, the symptoms daily became worse, and on Friday evening he died. Since writing the above, it is said that Rawlins, a shipwright, living at New Passage, and who had slightly scratched himself, is dead; and that another, residing at Torpoint, is at the point of death, from a similar cause."

It may be proper to observe, however, that Dr. Bell's death seems to be improperly ascribed to the poisonous quality of the timber. He perished, as many of his profession have done, merely from the infection of morbid matter, assisted perhaps by the agency of fear.

ON THE GENERAL NATURE AND ADVANTAGES OF WHEELS AND SPRINGS FOR CARRIAGES, THE DRAFT OF CATTLE, AND THE FORM OF ROADS.—BY DAVIES GILBERT, ESQ. F.R.S. &c.

(From the last Quarterly Journal of Science and the Arts.)

Taking Wheels completely in the abstract, they must be considered as answering two different purposes.

First, they transfer the friction which would take place between a sliding body and the comparatively rough and uneven surface over which it slides, to the smooth oiled peripheries of the axis and box, where the absolute quantity of the friction, as opposing resistance, is also diminished by leverage, in the proportion of the wheel to that of the axis.

Secondly, they procure mechanical advantages for overcoming obstacles in proportion to the square roots of their diameters, when the obstacles are relatively small, by increasing the time in that ratio during which the wheel ascends; and they pass over small transverse ruts, hollows, or pits, with an absolute advantage of not sinking, proportionate to their

diameters, and with a mechanical one, as before, proportionate to the square roots of their diameters. Consequently, wheels, thus considered, cannot be too large: in practice, however, they are limited by weight, by expence, and by convenience.

With reference to the preservation of roads, wheels should be made wide, and so constructed as to allow of the whole breadth bearing at once; and every portion in contact with the ground should roll on it without the least dragging or slide. But it is evident, from the well-known properties of the cycloid, that the above conditions cannot unite, unless the roads are perfectly hard, smooth, and flat; and unless the fellies of the wheels, with their tires, are accurate portions of a cylinder. These forms, therefore, of roads and of wheels, are the models towards which they should always approximate.

Roads were heretofore made with a transverse curvature, to throw off water; and in that case it seems evident, that the peripheries of the wheel should, in their transverse sections, become tangents to this curve, from whence arose the necessity for dishing wheels, and for bending the axes; which contrivances gave some incidental advantages for turning, for protecting the nave, and by affording room for increased stowage above. But recent experience having proved, that the curved form of roads is wholly inadequate for obtaining the end proposed, since the smallest rut intercepts the lateral flow of the water; and that the barrel strap confines carriages to the middle of the way, and thereby occasions these very ruts; roads are now laid flat, carriages drive indifferently over every part, the wear is uniform, and not even the appearance of a longitudinal furrow is to be seen. It may, therefore, confidently be hoped, that wheels approaching to the cylindrical form will soon find their way into general use.

The line of traction is mechanically best disposed when it lies exactly parallel to the direction of motion, and its power is diminished at any inclination of that line, in the proportions of the cosine of the angle to radius. When obstacles frequently occur, it had better, perhaps, receive a small inclination upwards, for the purpose of acting with most advantage when those are to be overcome. But it is probable that different animals exert their strength most advantageously in different directions; and, therefore, practice alone can determine what precise inclination of this line is best adapted to horses, and what to oxen. These considerations are, however, only applicable to cattle drawing immediately at the carriage; and the convenience of this draft, as connected with the insertion of the line of traction, which, continued, ought to pass through the axis of the wheels, introduces another limit to their size.

Springs were, in all likelihood, applied at first to carriages with no other view than to accommodate travellers: they have since been found to answer several important ends. They convert all percussion into mere increase of pressure; that is, the collision of two hard bodies is changed, by the interposition of one that is elastic, into a mere accession of weight. Thus the carriage is preserved from injury, and the materials of the road are not broken; and, in surmounting obstacles, instead of the whole carriage, with its load, being lifted over, the springs allow the wheels to rise, while the weights suspended upon them are scarcely moved from their horizontal level. So that, if the whole of the weight could be supported on the springs, and all the other parts supposed to be devoid of inertia, while the springs themselves were very long, and extremely flexible, this consequence would clearly follow, however much it may wear the appearance of a paradox: that such a carriage may be drawn over a road abounding in small obstacles without agitation, and without any material addition being made to the moving power or draft. It seems, therefore, probable that, under certain modifications of form and material, springs may be applied with advantage to the very heaviest waggons; and, consequently, if any fiscal regulations exist, either in regard

to the public revenue, or to local taxation, tending to discourage the use of springs, they should forthwith be removed.

Although the smoothness of roads, and the application of springs, are beneficial to all carriages, and to all rates of travelling, yet they are eminently so in cases of swift conveyance; since obstacles, when springs are not interposed, require an additional force to surmount them, beyond the regular draft, equal to the weight of the load multiplied by the sine of the angle intercepted, on the periphery of the wheel, between the points in contact with the ground and with the obstacle, and therefore proportionate to the square of its height; and a still further force, many times greater than the former, when the velocity is considerable, to overcome the inertia, and this increased with the height of the obstacle, and with the rapidity of the motion, both squared. But when springs are used, this latter part, by far the most important, almost entirely disappears, and their beneficial effects, in obviating the injuries of percussion, are proportionate also to the velocities squared.

The advantages consequent to the draft, from suspending heavy luggage on the springs, were first generally perceived about forty years since, on the introduction of mail coaches; then baskets and boots were removed, and their contents were heaped on the top of the carriage. The accidental circumstance, however, of the height being thus placed at a considerable elevation, gave occasion to a prejudice, the cause of innumerable accidents, and which has not, up to the present time, entirely lost its influence; yet a moment's consideration must be sufficient to convince any one, that when the body of a carriage is attached to certain given points, no other effect can possibly be produced by raising or by depressing the weights within it, than to create a greater or a less tendency to overturn.

The extensive use of waggons suspended on springs, for conveying heavy articles, introduced within these two or three last years, will form an epoch in the history of internal land communication, not much inferior, perhaps, in importance to that when mail coaches were first adopted; and the extension of Vans, in so short a time, to places the most remote from the metropolis, induces a hope and expectation, that as roads improve, the means of preserving them will improve also, possibly in an equal degree; so that permanence, and consequent cheapness, in addition to facility of conveyance, will be the distinguishing features of the M'Adam system.

A PROPOSITION.

Sir,—Allow me to circulate the following proposition through the means of your widely circulated publication. I pledge myself to navigate barges, or other vessels of burden, pleasure, or for passengers, on *canals* (or any other water), by a combination of powerful and simple machinery, which has *never yet* been put on board any vessel. The agitation of the water shall not be so much as to affect the banks of the canals: the weight of the machinery shall not exceed 300lbs.: the speed of the vessels may be regulated as desired. I will fit up a vessel upon this plan *gratis*, for any gentleman or company, as I do not make the proposition from mercenary views. I need not tell you, Sir, who must be experienced in the ways of the world, *why* I do not describe the machinery in the first instance, nor *why* I adopt, in lieu of my own name, the signature of PHILOPAT.

(Any communications to "Philopat." will be duly forwarded.—Ed.)

REMARKS ON "THE IDEA OF AN AIR ENGINE."

Sir,—Your Correspondent W.H.C will find, on referring to p. 381, vol. II. under the head of "The Case in Machinery," a few remarks, in some degree applicable to the subject he has started in No. 57, vol. III. In that paper I have stated, that no profit of power can possibly be obtained by the compression or exhaustion either

of an elastic or non-elastic fluid; nor can there, whatever may be the method of its application; and, therefore, I shall only make an observation or two on the particular idea of explosion.

Explosion denotes a sudden impetuous action, capable of generating great velocity, produced either by chemical change, or by letting loose any elastic fluid of great density. In letting loose an elastic fluid against any body of nearly equal resistance to the force of its power, a slow motion only will be produced, similar in effect to the action of steam against a piston, and which does not amount to the idea of explosion; but when such a violent action does take place, and great velocity is generated, the resistance of the body put in motion bears a very small proportion to the power by which it is expelled. In either case, however, whether we multiply the body of the greatest resistance by its velocity, or that of the smallest by it, we shall not find their effective forces exactly to compensate for the power absorbed in compressing the elastic fluid.

Fieldgate-street, Oct. 4. G.

Errata.—In page 381, for "1000 parts," *read* "a 1000 part;" and again, for "equal 1000 parts of the pressure of the atmosphere," &c. *read*, "equal to a 1000 part of the pressure," &c.

A NONSUCH PARTY.

A friend, who lately visited Paris, at one of M. Arago's *soirées* met with the following distinguished persons, all of them remarkable for having performed journeys or adventures, of which there was no parallel:—1. There was Professor Simonoff, who was astronomer to the Russian expedition into the Antarctic Circle, and who had been nearest to the *South Pole* of any man living. 2. Captain Scoresby, *Junior*, who had been nearest to the *North Pole* of any one living. 3. Baron Humboldt, who had been higher on mountains than any other philosopher. 4. Madame Freycinet, the only lady who had ever accompanied a voyage of discovery, and circumnavigated the globe. 5 M. Gay-Lussac, who had, we believe, been the highest in the air of any man. 6. M. Callien, who had travelled, with the son of the Pacha of Egypt, further towards the sources of the Nile than any person now living.

VALUE OF THE COTTON MANUFACTURES.

The value of the Cotton Manufactures exported during the twenty-two years of the late war, from 1793 to 1815, amounted to 208 millions sterling, at the official value. The raw material, at four millions per annum, amounts to 88 millions sterling. The net annual receipt from foreign countries, for profit and wages, was therefore 120 millions, or about five millions and a half per annum. But the whole value of all the British manufactures exported during that period was 548 millions; which, after deducting for the raw material 148 millions, will leave 400 millions added to the taxable capital of the nation, at the rate of more than 18 millions per annum, by amount received for the wages and profit of British productive labour. In the eight years since the return of peace, from 1815 to 1822, the cotton manufactures exported are upwards of 177½ millions, at their official value; and deducting five millions per annum for the raw material, leaves 137½ millions, being about 17¼ millions per annum; which being added to the export of the twenty-two years preceding, will make upwards of 257¼ millions contributed since the commencement of the late war, by cotton-manufactures alone, to the taxable capital of the nation. But in the last eight years, the whole amount of exported British manufactures is 332 millions; and deducting the raw materials, at the increased rate of 7½ millions per annum, will leave 272 millions, being about 34 millions per annum; which being added to the produce and profit of the wages for the twenty two years of the war, as before mentioned (400 millions), will make 672 millions received in the last thirty years, since 1793, being upwards of 22¼ millions per annum, for wages and profit pro-

duced by British industry, and received from other nations. During the war, the sum added to the national debt by loans was 569 millions; which, it thus appears, was exceeded, upwards of 100 millions, by the amount received from foreign countries for the ingenuity of the English artisan, and the industry of the English labourer.

ROMAN POLISH.

Sir,—Having frequently visited the Vatican during my stay at Rome, in the winter of 1818, I was much struck with the brilliant polish of their mahogany (if I remember right) bookcases; and as the then Pope Pius the Seventh was adding to the library, and putting up additional bookcases, that were made equally brilliant, upon the spot, I not only watched the progress, but asked one of the workmen how it was done. As I have read much about French Polish in your interesting Magazine, perhaps you would not object to a receipt for a Roman Polish, which has the advantage of requiring no varnish, and is very much at your service.

Brick dust, sifted very fine; olive oil mixed with it, just to give it the dampness of flour; this is rubbed by a pumice stone upon the wood till perfectly smooth; then add spirits of wine, and continue rubbing it till you have the required polish, which is beautiful, and more durable than any other.—Yours,

Polvore di Mattore.

I shall be very glad to hear that the above answers; and if any of your readers that has given it a fair trial upon a small scale will mention his success, it will be a general benefit.

REVOLUTION OF GOG-WHEELS.

Sir,—In Vol. ii. No. 56, of your useful publication, a problem is given, requiring the revolutions of certain cog-wheels, which I will endeavour to solve; but, as it will be better understood by adverting to the problem of R. G., in Vol. i. No. 16, which, as he requires a *simple* rule, I conceive has not yet been fully answered, I will first reply to that. As a general rule, if the greater number of cogs will divide by the lesser, and leave no remainder (for instance, 12 and 72), the quotient is the number of revolutions made by the smaller for one turn of the larger; and if the larger number cannot be divided by the lesser, and they are both divisible by the same divisor (as 27 and 36), then divide them by the highest; the revolutions of the large wheel will in that case be the quotient of the less, and *vice versa*; but if the larger will not divide by the lesser, nor both by the same number (as 43 and 127), the large wheel revolves as often as the smaller has cogs, and *vice versa*.

In J. H.'s problem (p. 445), C has 28 cogs, D 66; according to the above rule, $28 \div 2 = 14$, $66 \div 2 = 33$; therefore C revolves 33 times, and D 14. E has 60, F 28, $60 \div 4 = 15$, $28 \div 4 = 7$. E revolves 7 times, F 15. G and H having the same number of cogs, might, as far as the problem is concerned, have been left out altogether, as they only serve to change the horizontal to a perpendicular motion. I has 47 cogs, K 11; therefore I turns 11 times, while K revolves 47. E being fixed on the same axle as D, must have 14 revolutions also, which will cause F to have 30, G 30, H 30, I 30, and K 128 revolutions and 2 cogs, as is shown thus: 47 (the number of cogs in I) $\times 30 = 1410 \div 11$ (the number of cogs in K) $= 128\ 2$. But in order that K may make perfect revolutions, the revolutions of each wheel must be multiplied by 11, the number of times I ought to revolve: $33 \times 11 = 363$, $14 \times 11 = 154$, $30 \times 11 = 330$, $128\ 2 \times 11 = 1410$. Therefore, exclusive of A and B, the number of turns are thus: C 363, D and E 154, F G H and I 330, K 1410. As, however, A and C are on the same axle, they must, of course, revolve the same number of times; therefore the above numbers must be multiplied by 127, and A 127, and B 43 by 363: $363 \times 127 = 46101$, $43 \times 363 = 15609$, $154 \times 127 = 19558$, $330 \times 127 = 41910$, $1410 \times 127 = 179070$. Which process makes the answer to the problem thus:—B 15609, A and C 46101, D and E

19558, FGH and I 41910, K 179070, when they will, for the first time, have all resumed the places from whence they set out.

Yours, &c. F* S*

Sir,—In your 56th Number, page 445, there is a question proposed by your Correspondent J. H. respecting the Revolution of Cog-wheels. By inserting the following solution in your valuable miscellany, you will oblige, yours, &c.

Harpurley. Joseph Hall.

All wheels on the same shaft or axis make one or any number of revolutions in the same time: $127 \times 28 \div 66 = 53\frac{43}{33} \times 33 = 1778$, also $127 \times 33 = 4191$, and $43 \times 33 = 1419$. Again, 60 working into 28 is the same as 15 working into 7, then $1778 \times 15 \div 7 = 3810 \times 47 = 179070$; therefore the number of revolutions, by each wheel respectively, will be as follows:

A....4191 × 11 =	46101
B....1419 × 11 =	15609
C....4191 × 11 =	46101
D....1778 × 11 =	19558
E....1778 × 11 =	19558
F....3810 × 11 =	41910
G....3810 × 11 =	41910
H....3810 × 11 =	41910
I....3810 × 11 =	41910
K................	179070

TAPPING NUTS.

Erratum.—In the description of the method of Tapping Nuts, (No. 56, p. 445), for "one quarter inch nut," say, "*one inch and quarter*;" and in the second line after that, say, "*one inch and one eighth.*"

T. G. D.

Sir,—In perusing your valuable Magazine (No. 56, p. 445), I find a letter signed T. G. D. mentioning a simple method of Tapping Nuts with a smaller Tap. For my own part, I have practised the same these fifteen years, and have seen others do the same; so that I can assure T. G. D. (whoever that gentleman may be) that he is not the inventor, as he so politely wishes to appear.*

Your's, &c. J. W. M.

Gravel Lane, Southwark,
Oct. 3, 1824.

NEW PATENT.

To Alexander Nesbitt, broker, of Upper Thames-street, London, who, in consequence of a communication made to him by William Van Houten the Younger, a foreigner residing abroad, is in possession of a process by which certain materials may be manufactured into paper or felt, or a substance nearly resembling coarse paper or felt, which material so prepared is applicable to various useful purposes.—27th July.—Six months.

INQUIRIES.

NO. 67.—OIL-CLOTH PAINTING.

Sir,—Will any of your Correspondents have the goodness to say, what is in general used in the painted cloth manufactories to soften the rigidity of the linseed-oil, or, in other words, to render the cloths, when painted, pliable? C.

NO. 68.—BRICK-MAKING.

Sir,—I shall feel obliged, by any of your intelligent Correspondents bestowing their thoughts to the construction of a Machine for making Bricks. The principal objects required are, first, to supply the mould with earth; secondly, to press the earth into the mould, in such a manner as will expel as much of the water as possible; thirdly, that the machine shall strike off the superfluous earth from the mould, in such a manner as not to cling to the instrument; fourthly, that the machine shall not make less than ten bricks per minute.

A Subscriber.

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* This is not quite fair towards T.G.D.; since he stated, expressly, that he did *not* know whether the plan had originated with him or not, and communicated it to us merely because he believed it to be not *generally* known;—which, notwithstanding what our present Correspondent states, *is the fact.*—Ed.

NO. 69.—RE-FROSTING SILVER.

SIR,—I should feel greatly indebted to any of your readers, who could furnish a method of Re-frosting Silver that has become tarnished. It would be desirable if it could be done without fire, and I have heard that it can be effected.—Yours,

C. C. C. C.

ANSWERS TO INQUIRIES.

NO. 58.—PLANS FOR A COTTAGE.

SIR,—I return you herewith all the Plans of Cottages, &c. I shall adopt the plan exhibited by "Z. Z." which I highly approve for its neatness, convenience, and also as being the most suitable to the situation for which it is designed, and calculated to be executed at as little expense as any one I have received.

There are many of the others sent that are certainly very handsome designs, and displayed in a masterly style; but most of them are upon a scale, as regards the costs of the erection, far exceeding the present object.

I shall make one alteration in "Z. Z.'s" elevation, which is, to carry the building up square, and give it an overhanging roof of slate, instead of a parapet front. You will please to name this to him, in order that he may, if he pleases, make the alteration in the drawing, for insertion in your excellent and useful work, the "Mechanics' Magazine."

I send you herewith two guineas, to be paid to the author of the plan marked "Z. Z." and countermarked "X. X."—I am, Sir, &c. X. X.

["Z. Z." will receive the premium on application at 55, Paternoster-row, as also the approved Plan, which we shall be glad to receive back from him for insertion, with the alteration suggested by "X. X."—The other Plans are left with our publishers, to be returned to their respective owners when called for.—ED.]

NO. 10.—STEAM ENGINE CHIMNEYS.

SIR,—One of your Correspondents, some time since, having expressed a desire to get some information respecting Steam Engine Chimneys, I beg leave to submit a few remarks for his consideration. I believe the stacks, or engine chimneys, n Cornwall, till very recently, did not exceed sixty feet in height, and these chimneys are generally made circular, both internally and externally. Round stacks are certainly stronger than square ones, and equally good, if not superior, in point of draught. I suppose, your Correspondent of St. Anstel (p. 271, vol. II.) was not aware that there is a stack erected at Wheal Sparrow Mine, near Redruth, by the order of John Taylor, Esq. 122 feet above the level of the surface. The orifice, or draught-hole, is seven feet diameter at the bottom, and five feet at the top. Perhaps the draught would have been better, had the diameter continued of the same size from bottom to top, or increased with the height. Now, whether the additional height is more than commensurate to the expense of erection, I believe, has not been yet ascertained in this county; and when it is, you may, perhaps, hear from me again on the subject.

A MINER.

——, near Redruth, Cornwall.

CORRESPONDENCE.

Mr. Thorold, of Melton, near Windham, Norfolk, wishes us to assure our readers, that he is "not, either directly or indirectly," the author of any of the articles which appeared in "Nos. 30, 39, 40, 43, respecting Captain Manby's Inventions;" the same having, it appears, been busily, but erroneously, imputed to his pen.

A "Working Joiner at Bradford" is referred to our 56th Number, for what seems to us a better answer to the Query on Flooring.

An Amateur wishes to know "where he can get models of Mr. Watts' Single Engine and Double Engine (Figs. 26 and 27 in Mr. Stuart's Historical Description of the Steam Engine), and what would be their cost?"

Communications received from—"A Friend" at Harpurley—W. W—t—T.C.B. —Thomas North—Nathan Short—F. S. —Aurum—R. B. P.—George Abbot—James Yule—R.B.L.H.—L. A. J.—X. D. —J. T. H—d—Philpot—W. V. M.—Telos —N. Wales—A. R.

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Mechanics' Magazine,

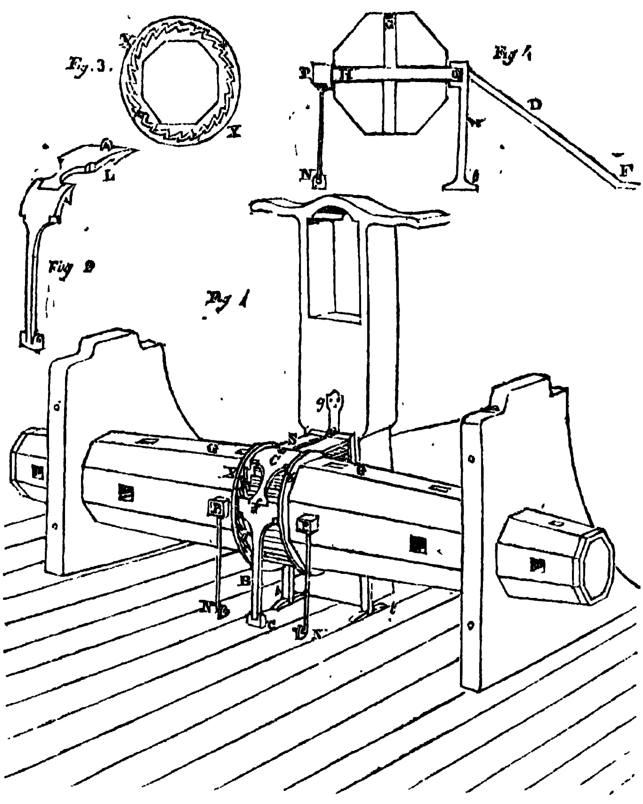
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

"The most valuable gift which the Hand of Science has ever yet offered to the Artisan." Dr. Birkbeck.

No. 60.] SATURDAY, OCTOBER 16, 1824. [Price 3d.

"Seest thou a man diligent in his business, he shall stand before Kings; he shall not stand before mean men."—*Proverbs* xxii. 9.

YETTS' PATENT APPARATUS FOR SECURING SHIPS' WINDLASSES.



SIR,—Allow me to offer you a Plate, with a description of Mr. Yetts' new windlass apparatus, which has met with very general approbation among nautical men.

I am, Sir,

Your most obedient servant,

July, 1824. NAUTICUS.

Description of the Plate.

Fig. 1 is a perspective view of a ship's windlass, with the apparatus applied thereto. B is the lower part of the safety pall, fastened through the deck to a beam under it, and moving with a joint at *e*. C is the upper part of the safety pall, moving on a joint at *f*. These two parts of the safety pall are kept to their place

against, and partly round, the windlass barrel, by means of a chain, S; which, in order to allow of the necessary play for the motion of the palls over the ratchets, is attached at one end to the flat spring, *g*, which is fixed to the pall bitt: *r r* are ratchets on one side of the ordinary cogs on the windlass barrel (the ratchets on the other side are, in this view, hid by the rim or flange, X). On the under side of the safety pall are teeth, which take into the ratchets, *r r*, and thus assist the ordinary palls of the pall bit in preventing the windlass from revolving in a direction forwards. X X are rims or flanges raised on each side of the ratchets, *r r*, for the purpose of keeping the safety pall in its proper place: *t t* are the bottom parts or feet of the perpendicular standard, described at fig. 4.

Fig. 2 represents a perspective view of the safety pall, showing the teeth or catches, L L, which take into the ratchets, *r r*, fig. 1.

Fig. 3 is a section of the windlass barrel, showing the form of the ratchets, *r r*, and their relative position with respect to the ordinary cogs of the barrel, as also the rim or flange, X X.

Fig. 4 shows a section of the windlass: H is the lever bar passed through one of the handspike holes in a horizontal position; the after end, P, being retained by a long hook bar going into an eye bolt in the deck at the end, N, and swinging on an eye joint at the end, P. The part marked G is to represent the perpendicular handspike hole, corresponding with the horizontal one which intersects it. O is the forward end of the lever bar, which enters into the bearing, R, which is supported from the deck by the perpendicular standard, W, and which standard is supported in turn by the diagonal bar, D, which is fastened to the deck at F.

AMERICAN CAPILLARY STEAM ENGINE.

We gave in our last two Numbers some valuable American documents respecting High Pressure Steam Engines, which had not hitherto appeared in print on this side of the Atlantic; and we are now, in like manner, enabled, through the kindness of an active Correspondent at New York, to be the first to lay before the British public the following interesting Report of the progress made in the application of a New Steam Engine, invented by an American machinist, called the Capillary Steam Engine. The results which it details are novel and important.

A REPORT
OF THE PROGRESS OF THE CAPILLARY STEAM ENGINE,

Submitted to the Patrons of that Invention.

Gentlemen,—Having been enabled, by your aid, to bring the project of a Capillary Steam Engine to the test of experiment, it is proper that I should give you an account of its success.

You will recollect, that the complete success of the scheme, to the extent anticipated in my public address, was predicated on the alleged discovery of Mr. Perkins. I had, long before that time, conceived the design of using a capillary tube for a boiler; in which tube the steam might be formed, as in the common boiler, or the material merely heated preparatory to the formation of steam in the main cylinder: but the practicability and peculiar advantages of each mode of using the tube remain to be ascertained by experiment. The splendid success said to have attended the latter mode in the hands of Mr. Perkins, induced me to come forward. Implicit confidence was placed in the testimony of the scientific men and journals of Great Britain; but when a drawing of his engine was received, with an explanation of its mode of operating, it appeared to me impossible that it could possess the powers and advantages attributed to it; and this opinion is now fully confirmed by our own experiments, as well as by a reference to the well-established principles of chemistry and mechanics. It is demonstrable from those principles, that when his engine was alleged to be working with a ten-horse power, and to be saving eight-ninths of the fuel usually consumed, it was, in fact, exerting less than a single-horse power, and consuming more than the usual quantity of fuel. I have deemed these remarks necessary, to account to you and to the public for our having failed to accomplish all that I anticipated in my address on this subject. It is not owing to any miscalculation made by me, and patronised by you, that we have not accomplished the whole;

but to the failure of an alleged discovery, which was vouched by the most distinguished men of science in Great Britain.

With the money and facilities furnished by you, I proceeded, as early as possible, to put the project into operation. A small capillary generator was constructed, and applied to a small engine belonging to Mr. Bruen; to whose scientific knowledge, practical ingenuity, and very accommodating disposition, I take this occasion to acknowledge myself greatly indebted. The tube used for the generator was made of copper, and was an eighth of an inch in diameter. At different times, we put in the fire from 9 to 36 or 40 feet in length. The apparatus was so small, that we could not arrive at any very conclusive results. We satisfied ourselves, however, that the scheme was practicable, that a copper tube would answer for a generator, and that the supposed discovery of Mr. Perkins was fallacious.

We then made arrangements for constructing an engine on a larger scale, calculated for a four-horse power; and as we still believed, from the experiments we had made, that it could be applied successfully to aerial navigation, we aimed particularly at lightness in all its parts. The generator was formed of a copper tube, one fourth of an inch in diameter and 100 feet long, and weighed about 16lbs. The steam cylinder was formed of sheet copper, was three inches in diameter, 27 inches in stroke, and weighed, with all its appendages, about 25lbs. A new mode of producing a rotatory motion was employed; and the whole engine, when put together, weighed about 115lbs. A wheel of sails, like that of a vertical windmill, was attached to it, to run horizontally above it, with a view to try its power to rise in the air. Upon trial, we found that the generator was coiled up too compactly to admit the application of sufficient fuel, and that the force pump did not supply sufficient water; nor did we like the success of the plan for producing a rotatory motion. From these defects, we were unable to make it work with more than a single-horse power; and the effect of this power on the wheel of sails, discouraged us from proceeding further in that branch of the project. Our object now was to make the necessary alterations in it, and apply it to some use, where its powers and utility could be effectually tested.

An opportunity of accomplishing these views was presented by Mr. Jackson, an ingenious and persevering manufacturer at Nicholasville. The engine was placed in his hands, and applied by him to work his cotton factory, where it has now been in constant and successful operation for several weeks. The factory was previously worked by three horses at a time on an inclined wheel; and the engine is found capable of running it faster, and with more regularity, than it was worked by the horses. The engine runs at the rate of forty double strokes in a minute, and the steam is cut off in the middle of the stroke. As no safety valve is necessary, and we have adopted no method, though we might easily have done it, to estimate the strength of the steam, we know not the height to which it is raised, but it is probably about 85 or 90 lbs. to the inch over the atmosphere. There is no limit, on the part of the generator, to the strength to which it may be raised, with perfect safety, and with increasing economy: the limit exists in the valves and joints, which probably cannot be made to resist more than three or four hundred pounds to the inch.

The generator now contains about 120 feet of the tube, most of which is one quarter of an inch in diameter. It is arranged in coils, one above another, in the form of a sugar loaf, 30 inches high, the bottom coil being 18 inches in diameter, and the top one considerably less. The wood is prepared as is usual for a stove, and put within the coils; the lower end resting on a hearth, a little below the generator, which is enclosed in a brick furnace, built in the fire-place of the sale room—a fire-place of the common size for a parlour; and the rest of the engine, with its fly-wheel and geering, stands beside the chimney, in the space usually occupied by

a closet. One cord of wood lasts two days and a half; at the present season, about 36 hours. The water enters at the top of the generator, and comes out in steam at the bottom. By using a greater quantity of tube, and placing more of it over the fire, in the ascending hot gasses, and at the same time raising the steam to two or three hundred pounds to the inch, and cutting it off sooner, it is manifest that a much greater economy of fuel might be effected. Perhaps the same quantity might be made to do double the work it does at present. In using the common boiler, the smoke necessarily passes off at a much higher temperature than that to which the steam is raised; whilst, by the capillary generator, the heat can be extracted from it, till it is reduced nearly to the temperature at which the water is put into the tube, though the steam be discharged red hot at the same time from the bottom of the generator.

Mr. Jackson condenses the steam by two old still worms, which he cools with water pumped by the engine from a well. The waste is supplied by rain water. This is indispensable in a limestone country, for the lime is deposited in the tube, and quickly fills it, if lime water be used: but the current washes out all other impurities—the lime deposited is as white as snow.

We have met with many difficulties and discouragements in the progress of our experiments, but they have all been surmounted. It is now conclusively proved that steam can be generated with facility and success, by a capillary tube, for any purpose whatever. There may be some particulars in which its management will be more difficult and troublesome than the common boiler; but they are not of much importance, or the difference will not be very great. On the other hand, its advantages are great and obvious; for all moving engines, by land or water, its lightness and compactness are a great recommendation. The generator and main cylinder, with their contents and appendages, exclusive of fuel, need not weigh more than 20 lbs. to the horse power. The bulk of the whole establishment need not exceed about three times the bulk of the fuel at one time in combustion. The economy of fuel may be carried to the greatest extent of which the laws of nature admit; for, by placing a sufficient quantity of tube over the fire, as already explained, the heat may be extracted from the smoke, till it nearly equals the temperature of the water entering the generator. This economy is further extended by the great strength to which the steam may be raised with perfect safety. No harm can be done by the bursting of boilers—even a safety valve would be useless. In the course of our experiments we several times burst the tube. So far from doing any injury, even at 500 or 1000 lbs. to the inch, it would not always be perceived by the spectators. With respect to the first cost of the engine, and the cost of necessary repairs, our experience does not enable me to give you any certain information. My opinion, however, is, that there will be considerable economy in this respect.

Three great objects are fully accomplished by this generator; they are lightness, safety, and economy of fuel—the two former, I trust, to the full extent of the public wishes; and the latter to the extent of nature, but not to the extent anticipated by public sentiment. And I must here add, that the general expectation can never be realized respecting the economy of fuel. The chemists have ascertained with precision the quantity of heat discharged in combustion, and the quantity of water which that heat will convert into steam; while the mechanical philosophers have experimentally proved the force exerted by that steam in expanding. From these data, the utmost effect which a given quantity of fuel can ever produce may easily be calculated, and it is found to be little greater than that to which we have already attained; and it is on these grounds that the alleged discovery of Mr. Perkins is demonstrably fallacious. We can never approach near the economy which he was supposed to have accomplished, unless, indeed, he could extract the heat from the steam, and

make it operate again, which I believe to be impossible.

With a view to ascertain what may possibly be done towards aerial navigation by steam, we have made experiments on the power of wings in the air, and on the power necessary to work them. The result is, that it requires a horse power to carry about 30lbs in the air; and we do not believe it possible to make a flying engine, to be worked by charcoal, which would weigh much less than 30lbs. to the horse power, wings, condenser, and fuel included. Had the supposed discovery of Mr. Perkins been well founded, by which this weight would have been diminished two thirds at least, the complete success of aerial navigation would not be still unaccomplished. The use of phosphorus for fuel would place us nearly on the same ground which we would have occupied under the discovery of Mr. Perkins with charcoal; and I firmly believe the project practicable by its use, but the expense is probably an insuperable objection. We have ascertained, by our experiments and calculations, that a balloon could be made to carry a man with an engine, which would push it at the rate of 15 miles an hour in the air.

In the navigation of shallow waters, this engine will be highly valuable to the country. It will enable us to traverse our western rivers, at all seasons of the year, with advantage; and to extend their navigation by steam to a great many places, to which the present steam-boats can never be taken. It will also be found applicable to land conveyance. Its lightness and compactness will admit of its being used for propelling waggons of heavy burthens on turnpikes and railways, and stage waggons for the mail, on all good roads.

July 12, 1824. JOSEPH BUCHANAN.

MINUS.

In treatises on Algebra, minus multiplied by minus is said to produce plus. I would deprecate the idea which some of your Correspondents are apt to entertain of applications of this nature, that they contain an attempt to overturn an universally received and well established truth; on the contrary, I am well convinced that this product is a true one, but not by my own understanding; and I could wish that some of your Correspondents would enable me to entertain a *rational* faith in this matter. The abstract idea of minus which I entertain, may be thus illustrated (if, indeed, it be abstract). A man owes 70l. but finds himself unable to pay more than 40l.; he is, therefore, minus 30l. or 30l. worse than nothing. Suppose him to be thus situated three times in his life, any number of negative terms is negative, producing seemingly -90. But perhaps the three times is an affirmative term, and therefore produces minus by unlike signs. How, then, can the idea of the second negative term or multiplier be entertained? If we designate any negative term by $-a$, what idea shall we attach to a multiplier represented by $-b$? How can $-a \times -b = +ab$ be explained by illustration? Can less than nothing multiplied by less nothing produce something?

In the only book to which I have access, this seeming paradox is thus explained:—"Lastly, when $-a$ is to be multiplied by $-b$, we have ab for the product at first sight; but still we must determine whether the sign + or − is to placed before the product. Now, it cannot be the sign −, for $+a \times -b$ gives $-ab$; and $-a$ by $-b$ cannot produce the same result as $-a \times +b$, but must produce a *contrary* result, to wit, $+ab$, in the same manner as + × + gives +."*

Now, does this follow, that because two NEGATIVES do not produce the same result as an affirmative and a negative, they must necessarily produce the same result as two AFFIRMATIVES?—Do they, indeed, produce any thing at all?

PIGER.

P.S. $a-b \times a-b$ presents no difficulty, though I am as unable to understand $a-b \times -b$ as the above.

* I conceive it should be $+a \times -b$, as before; however, it is printed as transcribed in Nicholson's popular Course of Mathematics.

CONTRACTION AND EXPANSION OF WATER IN COOLING.

Fill a thermometer tube with tepid water, and immerse it in a glass vessel containing water of the same temperature, in which a mercurial thermometer is placed. If the whole apparatus be now placed in a bed of snow, or in a frigorific mixture, the water in the tube will gradually contract, till the mercury shows the temperature of 40°; it will then begin to expand gradually until it becomes ice. From this simple experiment the reader may see, what is otherwise, however, a well-established fact, that the specific gravity of water is greatest at 42°. The expansion of this fluid, when cooled still further, is an *exception* to the general law of bodies expanding by heat and contracting by cold; and as we are unable to account for it, or refer it to any class of facts, it seems like a perpetual miracle, and may excite both our wonder and our gratitude whenever it is contemplated. It is in consequence of this miracle that ice swims on water, and does not sink down, choking up the streams and stopping the currents of the rivers, the continued flow of which is as necessary to the existence of the world as the circulation of blood is to our existence.—*Chemist.*

SIR HUMPHRY DAVY'S REMEDY FOR THE DECAY OF SHIP BOTTOMS.

The result of the trials which have been made under the direction of the Lords of the Admiralty, to determine the efficacy of Sir Humphry Davy's new remedy for the Decay of Ships' Bottoms, is not, we regret to learn, so satisfactory as was at first anticipated. It has been found, that though the copper is indeed preserved from corrosion, through the medium of the galvanic action, it soon gets remarkably foul; some vessels coppered on this plan having returned, after short voyages, with their bottoms completely covered with barnacles, weeds, &c. It is but due, however, to the Learned President to observe, that he was not without his apprehensions that such might possibly be the effect of the application of the principle which he has shown so much sagacity in developing (See Mech. Mag. p. 342, vol. II.) Mr. Children, too, in defending Sir Humphry's claims to originality in this application (p. 343, ibid.), not only explained how copper thus defended would be more liable to become foul (from the absence of that poisonous oxide which covers the surface of undefended copper), but pointed out such means of counteracting this tendency as leads us to hope that it may yet be remedied. "All that is necessary," says Mr. Children, "is to weaken the defensive action, by diminishing the extent of the defending surface to such a point as to allow a slight oxidation of the copper, sufficient to repel the animalculæ, but not sufficient to occasion a serious waste of the metal."—We presume that this yet remains to be tried.

SIMPLE PLAN OF SCAFFOLDING.

SIR,—In one of the Numbers of the Edinburgh Monthly Magazine and Review for the year 1810, is inserted a description of a simple, secure, and ingenious Scaffold for ascending Steeples, &c. It is stated to have been employed at the town of Birmingham; and the person who contrived it is said to have ascended the spire of a steeple at that place in the course of a few hours. Deeming it might be of use to your numerous readers, I have sent it to you for their use.

His method is thus described:—Having ascended the bartisan through the winding stair of the steeple, he placed a rope round the spire; to this rope was hung a number of triangular frames, by a strong iron hook at one of their corners: on these triangular frames were placed planks, and the scaffold was completed. Ascending this scaffold by a short ladder, the same operation was repeated, until he reached the vane or weathercock; thus forming a succession of scaffolds parallel to each other.

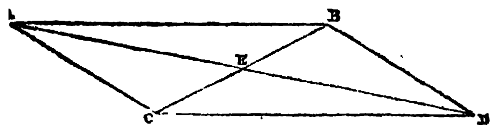
I am, Sir,
Your obedient servant,

JAMES YULE.

MECHANICAL GEOMETRY.

SIR,—I observed in a late number of your useful Magazine a communication, signed "G. A. S," containing some problems in geometry, or rather useful directions for the practical mechanic, to enable him to execute his work with greater accuracy. Your Correspondent, however, gives a rule for ascertaining whether a parallelogram, or four-sided figure, is square; or, in other words, whether its four angles are right angles, which does not appear to be altogether accurate, at least in the way he states it, and which may mislead the unwary who trust to it.

Your Correspondent says, that if the two diagrams of a parallelogram intersect each other in the middle of each respectively, that is, if the parts on each side of the point of intersection are equal, the angles will be right ones. But this does not hold true, unless the diagonals are equal, which he does not mention in his rule; for in any parallelogram, as ABCD, of which the opposite sides are respectively equal and parallel, the diagonals will divide each other into two equal parts, whether it is a right-angled parallelogram or not; that is, if AB is equal to CD, and AC equal to BD, AE will be equal to ED, and BE to EC.



Moreover, the method proposed by your Correspondent does not appear to me, at least, to be better, or even so good, as the common method used by workmen, viz. simply making the diagonals equal; for, in any parallelogram, if the opposite sides are respectively equal, and the diagonals equal, the figure must be right-angled. Now, I think, the workman, in ascertaining whether a frame, or any piece of work, is square, will find it as easy a process to try if the opposite sides are equal, and then measure the diagonals by the usual method, as to have two diagonals, and bisect them in the middle; besides, unless his two laths are perfectly straight, they will not intersect exactly in the middle.

I am, Sir, yours, N. B.

REPLY BY G. A. S TO THE PRECEDING COMMUNICATION.

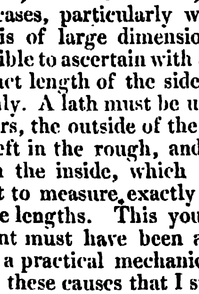
SIR,—I feel obliged by your Correspondent, "N. B." pointing out what he thinks an inaccuracy in the 7th Problem of Mechanical Geometry, for I should be sorry that any obscurity should be perceptible in what is written expressly for those not initiated in the science of geometry; but if he had looked at the preceding theorem (the note to p. 381, vol. II.), he would have seen at once, that Problem VII. was intended to show, that though AB and BD were equal, it was a fallacious proof of the accuracy of the square or rectangle; and, therefore, when the direction was given to measure the diagonals, it presupposes them to measure equal, or that AB measures the same as BD (for if they do not, the frame cannot be square). Now, by referring to the original paper, of which I sent you a copy, I find the words, "*which we suppose to measure the same as AC,*" interlined in a parenthesis, and perhaps omitted inadvertently in the paper I sent you: I therefore think it would be the better way to insert, as an erratum, the following, which, I think, will remove every obscurity.

ERRATUM.—Page 376, vol. II. col. 1, line 13, after the words, "the distance BD," insert, "which we suppose to measure the same as AC."

This, I think, will completely satisfy your Correspondent, "N. B." who, if he had read the paper preceding that which he alludes to, would have found that I was not ignorant of the property of the diagonals of a parallelogram bisecting each other; for Theorem VIII. is the very same that his communication establishes; and

he will find that Problem VII. is meant to prove the fallacy of *simply* measuring the diagonals of any quadrilateral, without first ascertaining that the opposite sides are *exactly* equal.

Now, with regard to the method I have proposed being inferior, or at least not superior, to the one in common use, I must remark, that in many cases, particularly where the frame is of large dimensions, it is impossible to ascertain with accuracy the exact length of the sides with a rule only. A lath must be used; and in others, the outside of the frame is often left in the rough, and mouldings on the inside, which render it difficult to measure exactly their respective lengths. This your Correspondent must have been aware of, if he is a practical mechanic; and it is from these causes that I still insist upon the method I have proposed, as not only superior, but in many instances more ready, particularly should the frame have one or more of its sides curved, as the following diagram will clearly demonstrate:—



Let A B C D be a sash frame, for instance, the top of which, as C B, is a portion of a circle; now, if we find A B equal to C D, and the centre of each at E correspond, we are sure that the angles at A and D are right angles. Now, according to the common method, if the frame is large, or even of moderate dimensions, it is impossible to ascertain the length of the chord C B without a lath; and even then, if there is a moulding or bead round the frame, it will be extremely difficult to measure C B with accuracy; but by the method I propose, it is easily and expeditiously done.

I could enumerate many more cases to prove the same, but, I am sure, to the practical workman they will naturally present themselves.

I think I have now said sufficient to demonstrate to "N. B." the truth of what I have advanced; and shall only add, that as I am sure he has been influenced by the best of motives, in detecting any error that might mislead the workman, I trust that, in candour, he will allow that the omission pointed out will free the problem from any appearance of inaccuracy.

Yours, &c. G. A. S.

GUNTER'S LINE.

SIR,—Your Correspondent, 'Unit,' did not err, when he stated his belief, that an explanation of the Gunter's Line would be acceptable to more of your readers than himself. I, in common with, I doubt not, hundreds besides, look to your Magazine for instruction, which I must otherwise go without. Myself, and two others known to me, have experienced the same difficulty with the two-feet Gunter which 'Unit' did with the sector. You may judge, therefore, how gladly I saw the application of 'Unit' appear in your highly useful work, and how eagerly I noticed the description furnished by 'Monad.' I would, with all humility, remark to him, however, that the saying of Isaiah, "Precept upon precept, and line upon line," conveys a lesson fully as much to the teacher as to the learner. There are, unfortunately, too many learners who, from the circumstances in which they find themselves, stand in need of repeated explanation. A word is sufficient for the *wise*, but the ignorant stand in need of many. An ancient writer has said, "*Literæ facile discuntur si habeas qui docere* FIDELITER *possit.*" (By *fideliter* I would understand THOROUGHLY.) I have, by the help of several friends, searched London in vain for a treatise on the use and practical application of the Gunter's Scale, "which most puzzles" us; I would, therefore, beg 'Monad,' and such as can have compassion on the ignorant, and a feeling for their infirmities, to follow up the descrip-

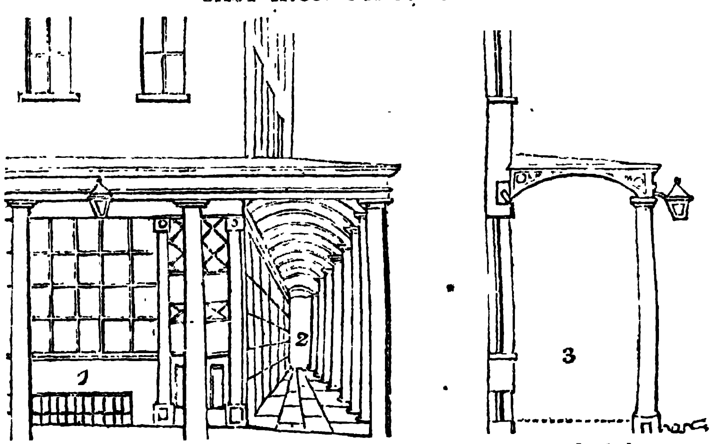
tion already given; which, though extremely clear, so far as it goes, yet leaves the subject *in limine*.

To illustrate MY wants, and those of my friends, I would remark, that the explanation in No. 54 has enabled me to understand the following cases in Barlow's Mathematical Dictionary:—1st. To multiply 4 by 8. 2nd. To divide 36 by 4. 3rd. To find a fourth proportional to 6 8 9. 4th. To find a mean proportional between 8 and 32 ('Unit's' example.) And 5th. To extract the square root of 25. But in all these cases, every one must consider the multiplication table more useful. If any of your Correspondents would kindly instruct us how to manage two or more places of figures, *e.g.* 46 × 54, or 2484 ÷ 46; or to extract the square root of 324, they will confer an obligation on

Your humble Correspondents,

JL. GP. HS.

CAST IRON COLONNADES.



SIR,—Plans for subways of various descriptions have long been before the public, but Cast Iron Superstructures or Colonnades, for a somewhat similar purpose, have never yet been presented to the public eye. I therefore, Sir, submit the following description, accompanied by different views, for insertion in your work, should you think them worth the notice of your numerous scientific readers.

The extreme durability, the considerable cheapness, the vast utility in conveying the water and gas pipes, in protecting the passengers from the rain, and in supplying the shops with a grand substitute for sun shades, are in themselves points of such consequence, that both the man of research and the common observer will, I trust, ere long, view with delight the plan which I now submit, and give it such patronage that we may, before the year 1830, be enabled to walk from one end of the metropolis to the other without being exposed either to the heat of the sun, or the unpleasant effects of rain.

The simplicity of this 'iron scheme' affords it a much better chance of public patronage than some of those enormous and arduous undertakings which have, of late, been proposed, and which have certainly perplexed the mind both of the philosopher and mechanician.

Description of the Drawings.

No. 1 is an elevation of part of a cast iron colonnade, before a shop at the corner of a street.

No. 2 is a perspective view of the colonnade. This is introduced merely to give the reader and promoter an idea of the grandeur which it would impart to the streets of the metropolis.

No. 3 is a section, showing the construction of the framing, the situations for the water and gas pipes, and likewise for the lamps. The framing is made of

the width of the foot pavement, supported by light cast iron columns, ten feet from centre to centre next the road, and fixed in stone abutments inserted in the walls of the houses.

The gas pipe, *a*, is so placed that ready communication can be made to supply the lamps, which are placed in front of the framing, as shown in the drawings. The water pipes may occupy the space *b b*, and they can at any time be readily repaired, as, by taking up the lead covering, and then the cast iron plates, they can be entered upon without inconvenience or impediment to the foot passengers.

If this be carried into execution, will it not, I ask, be as great a public improvement as has of late years been submitted for the public approval?

I am, Sir, &c.

JOHN T. WEDDEBURGH, C.E.

APPLICATION OF SMITH'S PATENT STEAM BOILER TO THE BOILING OF SUGAR.

In our 35th Number (p. 104, vol. I.) we gave a description of a valuable apparatus, invented by Mr. Smith, for drying, boiling, and evaporating liquids by steam, and mentioned that it had been employed with great success, in the West of England, in the manufacturing of salt from brine. It now appears, from a series of experiments instituted by a number of gentlemen connected with the West India Colonies, that it may, and is, likely to be applied with equal efficacy to the boiling of sugar. The peculiar excellence of Mr. Smith's boiler (as our readers have been apprised) is, that it gives, by means of compressed steam, any degree of heat required, and yet never burns the material submitted to its action. It was at first apprehended that the temperature required for the crystallization of sugar was higher than this boiler could sustain; but the result of the experiments, which we have now to detail, has proved most triumphant in its favour.

EXP. 1st.—The boiler was filled to one-third of its contents with water, and one pound of sugar in proportion to each gallon of water was added: the whole boiled briskly in ten minutes, and in 58 minutes from the time the fire was lighted, the sugar was so much concentrated as to crystallize easily. Some part of the sugar was left in the bottom of the pan, which crystallized without any degree of carbonization, though a heat of 244 degrees was applied; and during the whole process there was none of that empyreumatic odour which uniformly accompanies the boiling of sugar in an ordinary caldron.

EXP. 2nd.—The sugar experimented with in this instance was East India. The great objection to this article of commerce is, that though in colour it is superior to almost any West Indian sugar, it is just as far inferior in grain or crystal: this, it is supposed, arises from some want of knowledge or care in its manufacture. A quantity of fine Benares sugar was put into the boiler, and in 22 minutes after the fire was lighted, it was declared fit for being potted.

EXP. 3rd.—A like quantity of fine Benares sugar as that employed in the preceding experiment was put into the boiler, *when hot*, and was prepared in eleven minutes.

The loaf sugar thus produced is very fine for a first claying, but it is feared that there will be a considerable loss in the draining off of syrup and molasses.

EXP. 4th.—The next point sought to be ascertained was, whether the new steam boiler can improve the grain of inferior West Indian sugars? and in this it has completely succeeded. Two charges, or skeppings, as they are technically termed, were run off in thirteen minutes and a half each.

From the result of these experiments it is confidently expected that a great improvement has been discovered in sugar boiling. Molasses, which is an uniform product of the ordinary mode of concentrating the cane juice, is supposed to arise from a carbonization of the saccharine matter during the process of boiling. Should this be the case, a saving of 33 per cent. will take place in the boiling of sugar, and an article will be produced so superior to that which comes to this country under the name of Muscovado sugars, that it will be unnecessary to make it undergo an additional process of refining when at home.

Mr. Pickering, in our 36th Number, having expressed his regret that he did not communicate his ideas on high pressure steam boilers at an earlier period, and Mr. Smith's patent apparatus

for applying steam to manufacturing purposes becoming now an object of some importance, we are requested, by the latter gentleman, to give a place in our pages to the following statement of the time and cause of his turning his attention to the subject:—

In the summer of 1822, Mr. Furnival, of Birmingham (now partner with Mr. Smith in his patent), having formed the idea, that if a vessel could be constructed for applying steam to the manufacture of salt, it would be attended with great advantage, he applied to every person in England that he thought likely to assist him in realizing the project, but from all of them he received for answer, that the thing was impossible. Not satisfied, however, in his own mind that it was so, he went down to Scotland, and obtained an introduction to Mr. Smith, who stated at once, that of the possibility of the thing he had no doubt; but as to the most convenient way of accomplishing it he could not then exactly speak (although he had been manufacturing salt with steam, under a Scotch patent, ever since the year 1813). He promised, however, to take the matter into consideration, and to let Mr. Furnival know if he should fall upon any method of constructing a vessel that would be safe and convenient for the purpose. This was in the latter end of September, 1822, and, by the 5th of November following, Mr. Smith went to Birmingham, having by that time planned and given orders for the construction of his present boilers, which have now been at work more than twelve months.

From the above statement Mr. Pickering and the public will be able to judge to whom the merit (if there be any) of the first discovery belongs. That Mr. Pickering planned such a boiler, without knowing any thing of Mr. Smith's, the latter is perfectly satisfied; but their object seems to have been quite different, as Mr. Smith only intended his for manufacturing purposes, while Mr. Pickering, it appears, had only in view the construction of a safety boiler for high pressure steam engines.

RULES FOR CALCULATING THE PRICE OF TIMBER.

SIR,—In Number 57 of your Magazine, a Correspondent has shown some short rules for calculating the price of timber, in which he gives us two examples; one where the price of an hundred is given to find the price of one, and the other where the price of one is given to find 100. It appears to me, however, that *his rules are no rules at all*; for, if deals be at 36*l.* 10*s.* per hundred, one deal will cost 7*s.* $3\frac{1}{2}\frac{3}{5}$*d.* instead of 6*s.* 1*d.*, as he says.

A much shorter way than his, and one which will give a much more accurate answer, is this:

RULE. Take the number of pounds per hundred, call them shillings, and divide by 5, which will give the price of one deal in shillings.

EXAMPLE. Deals cost 50*l.* per hundred, what is the value of one?

5)50*s.*

10*s.* the value of one deal.

For calculating the price of 100, when the price of one is given.

RULE. Multiply the price of one by five, and call the product pounds.

EXAMPLE. A deal costs 5*s.* what is the price per hundred?

5*s.*
5

25*l.*

In some instances this way will be found to vary a farthing or two from the correct answer, but, on most occasions, it will be found to answer every useful purpose.

I am, Sir,
Your obedient servant,

Winchester, Sept. 30. T. C. B.

DIPLOGRAPHY.

SIR,—Through the medium of your widely circulated and useful miscellany, permit me to inquire if any one can describe the system of "Double Writing," said to have been discovered by Sir Christopher Wren, about the year 1647? In a life of Sir Christopher Wren, published in "The Grand Magazine of Maga-

zines," for November, 1758, I find the following account of this curious invention :—

"But what seemed the most admirable of all, he invented the art of *double writing*, by making two several pens to write the very same words on two distinct papers, and that with as much ease and beauty as is found in common writing, with this peculiar advantage, that one writing was not to be distinguished from the other by the strictest scrutiny. This invention was, however, contested; and Sir William Petty having obtained a patent from the Parliament in 1647, about three years before Mr. Wren publicly produced his *diplographical instrument*, for an invention of the like kind, he found it necessary to assert his right to priority by appealing to his friends, to whom he had communicated its effects."

I am, Sir,
Your most obedient servant,
Chequer Yard, Bush Lane. A. L. Z.

MEASUREMENT OF TIMBER.

SIR,—No. 32 of your useful Magazine contains an exposure of the erroneous, yet very prevalent method of measuring round timber — the taking one-fourth of the circumference for the side of the square. Connected with the same kind of measurement is another practice equally erroneous. Few sticks of timber are of equal diameter throughout: most are considerably less towards the upper end. The common method is to take the diameter or circumference of both ends, add them together, and take the mean for the diameter, or the circumference, as it may happen to be, for the whole: thus a stick, the greatest diameter of which should be 32 inches and the least 16, the mean diameter between these two would be 24, the area of the circle of which is but 452; but the areas of the two extreme circles, added together, is 1005; divided, 502½ inches. Consequently a stick 40 feet long, of the above assumed diameters, would measure by the common method only 125 feet, by the correct method 139 feet; being a difference of 14 feet.

This difference is not quite so much as that pointed out by your correspondent Mesurage, yet I think it is sufficient to deserve notice. If the results of these errors stood in opposition to each other, the difference would not be so very great; but as both tend to lessen the real measurement, they deserve the attention of all who may have dealings in the timber trade.

I am, Sir, &c. R. H.

DIFFICULTIES TO SOLVE.

It is an admitted principle, that water increases friction, and oil diminishes it. What, then, is the reason why a steel edge-tool is quicker *set* upon a Turkey stone with oil than with water? Whether does the abrasion proceed from chemical or mechanical action, or from both?

What is the reason why a screw-nail is *screwed home* much easier with a *long* than with a *short* screw-driver, the handles in both cases being alike?

What is the reason why a drill, when heated by boring, attracts steel or iron filings? (This phenomenon is very observable when boring steel or iron.) Is the attractive power negative or positive? Is it electrical or magnetical? And what is the primeval cause of attraction?

Yours, &c.
J. Y.

PROJECTILE AND GRAVITATING FORCES.

SIR,—I have this day received Part XIV. (only) of your valuable work, in which is contained an attempt at a refutation of my former paper by your Correspondent G. A. S. Our surprise is mutual; and his surprise and regret at my ignorance will, no doubt, be augmented, when he finds that I am not convinced of the truth of his *lucid demonstration*.

It is evident, that any two *uniform* forces are, in proportion to each other, as the velocities generated in the same space of time; the ratio of the forces is the same, whatever time may be employed in generating the forces.

But when a variable, accelerating, or *gravitating* force is to be compared with a uniform or *projectile* force, the ratio of the forces will not be the same for equal portions of time in

succession, as the ratio of the *projectile* and *gravitating* forces are inversely as the times in which the forces are generated.

Now, if we suppose the earth to be situated at *a* (2d col. p. 338, vol. II.), the centrifugal or projectile force in the direction *a b*, in one second of time, must be ten million times greater than the centripetal or gravitating force in the direction *a s*, in order that the earth may revolve in a circle, as is evident from the ratio of the projectile force (98800 feet), and its versed sine (0.009837), or gravitating force; for in such proportion does the projectile force exceed its corresponding versed sine. It is, therefore, absurd to insinuate that the projectile and gravitating forces are equal in circular orbits, as no such property obtains. In order to obtain the ratio of the forces in the present case, we ought to employ an indefinitely small space of time. Now the sine, arc, and tangent, are all equal to each other in their first or *nascent* state; we may, therefore, assume that the arc is equal to the tangent in this case, or the circular equal to the tangential force. Now, the sine being indefinitely small, the cosine will consequently be indefinitely great; and as cosine + versed sine = radius, the versed sine or gravitating force will evidently be indefinitely small also, or less than any assignable quantity; for the versed sine, or gravitating force, is equal to the square of the arc or projectile force divided by the diameter of the planet's orbit. Or, as the diameter of the orbit is to the projectile force, so is the projectile force to the *gravitating force* (and which, for an indefinitely small space of time, is equal to *half the square of the projectile force*). Hence, when the projectile force is infinitely small in respect to the diameter of the planet's orbit, the gravitating force must be infinitely small also. In respect to the projectile force, we may therefore assume that the projectile is infinitely greater than the gravitating force, for an indefinitely small space of time, in a circular orbit.

Suppose the projectile force to carry a body through a certain portion of its orbit in four seconds of time; suppose, also, another body to describe the same space in two seconds; and, lastly, a third body to describe the same space in one second. The ratio of the forces will still be the same in each case, although, in the second case, the projectile force is double, and in the last, quadruple, of what it is in the first case. The central force is found to be double and quadruple, because arcs bear the same proportion to the versed sines, being, in fact, identically the same in each case. How, then, can a double projectile force be said to balance a quadruple power of gravity?

It is usual, I believe, to compute the forces from a *constant* tangent bisecting a *given point* in a planet's orbit; according to which practice your Correspondent G. A. S. will probably favour us with the ratio of the projectile and gravitating forces for 30, 60, and 90 degrees of a planet's angular motion, and likewise the ratio of the said forces and deviation from the said tangent, when the planet is passing through the opposite semicircle of its orbit. Your Correspondent, in order to show that a double projectile force is always equivalent to a quadruple power of gravity, admits the projectile power to be such as to carry the body from A to B in the same time as the force of gravity would carry it from A to C; the forces in this case are consequently equal, in passing from a state of quiescence. Now, your Correspondent surely does not mean to contend, that these forces will carry the planet in a circular orbit, as he says that the force of gravity is continually increasing. Granted it is so, and consequently the planet would sooner arrive at the sun than if the forces were uniform, as it would be impossible for the projectile force to overcome the central force, in spite of any thing your Correspondent may say to the contrary, unless the forces impressed in the two directions at the commencement of motion were in a very different ratio.

The reason, I presume, why a double projectile force is said to balance a quadruple power of gravity, is from the relation which a small *arc* bears

to its *versed sine; i. e.* the versed sine of a small angle is *four times* greater than it is for the half of that angle, while the arc is *double* only. Hence the ratio of the forces are inversely as the times in which the forces are generated. But if we suppose a planet to commence its motion from any point in its orbit, it will have passed over a certain portion of its orbit in one second of time, the versed sine of this arc is equal to the difference between the tangential and circular motions, and the planet will, of course, have acquired a different line of direction, or a deviation from its original course, equal to the planet's angular motion in its orbit; and so on for each second of time successively, making as many tangential directions as there are moments of time, the deviations from the tangential directions being constant in all parts of a circular orbit; and in elliptical orbits the above ratio will be as the radius vectors of the orbits. In fact, there is no particular tangent to compute from, as the motion of a planet, in every part of its orbit, is composed of an infinite number of tangents, and, therefore, the computations ought to be made from the tangent (or the direction acquired) immediately preceding the instant of time for which the ratio of the forces is computed. We are told, that for one hour the ratio of the forces is double, for two hours quadruple, &c. Quere, the ratio of the forces from the creation of the world to the present time, or for 6000 years, at the same rate? I wish, however, to impress on the mind of your Correspondent, that it is not the ratio of the forces for an arc of 30, 60, or 90 degrees, that is required to illustrate my proposition, but simply the *ratio* of the forces necessary to retain a planet in a circular orbit.

Having extended this paper to a greater length than I at first intended, I shall, therefore, conclude with begging of your Correspondent to be merciful, as he pledges himself to show the *fallacy of my arguments*, even if I present him with *a mathematical* DEMONSTRATION OF THE TRUTH *of what I assert!*

Oct. 1, 1824. MAJERTINGUN.

P.S. If your Correspondent refers to Martin's Mathematical Institutions, vol. II. p. 73, or to the Imperial Encyclodedia, by Mr. Exley, vol. III. p. 454, he will there find, for his *edification*, from a *fluxional* solution, that the *projectile force* infinitely exceeds the *central force* in circular motion!

HINTS FOR IMPOVEMENT OF THE COMMON LATHE.

SIR,—On looking over No. 24 of your Magazine, a most valuable medium through which every one may add his mite to the fund of information, I was much pleased, though no practical mechanic, with the improvement of the Turning Lathe, by Mr. E. Williamson, without anticipating the inconvenience pointed out in practice by W. K. S——N, in No. 32, whose improvement would certainly prevent the friction of the band, but, at the same time, would take away at least one-half of the power of the band from the working part of the lathe. With submission to practical and, therefore, better judges, it appears to me, that if the working pulley of the lathe had a sufficiently wide flat groove, and that if to Mr. Williamson's was added a small friction-wheel, or roller, low enough to receive and guide the band upon that pulley, and another above, to receive the band as it came off the pulley, these contrivances would prevent the friction of the band, and, at the same time, secure its full power upon the pulley. These friction-wheels should be metal, and work upon a small axle, which might easily be fixed to the head of the lathe.

I am, Sir, &c.

Wellingborough. A. B. C.

[An improvement nearly similar to that here suggested is described by another Correspondent, at p. 408, vol. II. as having been put in practice.—ED.]

PRICE OF STEAM ENGINES IN FRANCE.

The immense price charged for Steam Engines in France has deterred many persons of limited capital from employing them. There are

not more than three steam engine manufactories in France, the largest of which is in Paris, which belongs to Cassimir Perrier and other French and English capitalists. The engines are there charged double the amount which is paid in England. In intrinsic quality they resemble our own; but, although this manufactory is superintended by an Englishman, the French workmen know so little how to handle iron, that the engines are any thing rather than specimens of perfection as to outward appearance. Many private gentlemen in France have had small steam engines erected upon their grounds, for the more plentiful supply of water. Monsieur Lafitte (a first-rate Paris banker) has one at an estate near Paris, which cost him upwards of 30,000 francs (1250*l.* sterling).

FRENCH POLISH.

SIR,--You will oblige me by making the following inquiries, as your Correspondent, "Josias Murray," in p. 272, kindly promised further information, if required:—

1st. Does his method apply to new work or old?

2nd. If to new, what process (if any) is necessary before putting on this mixture?

3rd. With what is it to be "well washed off?"

4th. If with water, warm or cold, will it not raise the grain of the wood?—and,

5th. How is the wood to be made smooth again?

Aug. 20. A CONSTANT READER.

SAFETY FOR THE DEAD.

SIR,—Cannot some of your numerous readers furnish the means of applying a detonating principle to a pound of gunpowder, to be placed inside of a coffin, so as that, on its being forced open, the powder should explode and blow up the resurrection-man? I think the thing very practicable, and that it might form a profitable subject of a patent. No danger could possibly ensue to innocent people; for, in the course of a fortnight or three weeks, the gunpowder would lose its efficacy, from damp, and, at the end of that period, the body would be too far gone to be an object of theft.

I am, Sir, yours, &c.

Holborn, Aug. 6th. T. P. A.

PROBLEMS.

1st. From any given parallelogram it is required to cut off from each corner its fifth part, so that the remaining fifth part shall be a parallelogram similar to the original figure.

2nd. Within a given parallelogram to describe another, that shall be equal to 2-5ths of its area, and divide the remainder into four parts, whose areas shall be mutually equal.

G. A. S.

INQUIRIES.—No. 69.

SIR,—Being desirous of *polishing* and *splitting* some large fossil remains, composed chiefly of ferruginous limestone, I wish to erect a lathe to enable me to accomplish my purpose with a greater facility than arises either from friction on a plain surface, with sand interposed, or from cutting with iron and sand. Will any of your Correspondents have the goodness to inform a brother reader of the "Mechanics' Magazine," how many different sorts of grindstones will be requisite, and where I can procure them?

I am, Sir, &c.

O. S. R. A.

Sheerness, August 22.

NO. 70.--ARCHITECTURAL DRAWING.

SIR,—In delineation of our ancient architecture, I have often experienced a great deal of trouble and inconvenience in drawing the profile of the *mouldings* or ornaments in an accurate manner, without first being at the trouble of taking a *cast* in *plaster* or *clay*, which, by-the-bye, is not a very clean nor yet a very pleasant operation. Now, to avoid this irksome method, if any of your inge-

nious Correspondents will, through the medium of your truly valuable work, give a more expeditious, and at the same time a cleaner method, they will confer a great benefit on,

Sir, yours truly,

FINICAL.

Manningtree.

NO. 71.—REGULATING THE HEAT OF HOT-HOUSES.

SIR,—I have had an application from a gentleman residing in the country, for information respecting an invention for regulating the Heat of Hot-Houses. Such an invention was patented, I believe, some few years since, and was considered at the time, I recollect, to possess great merit, both as to the perfect originality of the idea, and the success with which it effected its intended object. If any of your Correspondents will have the goodness to give a reference where one of these machines may be seen at work, and also give a description of the principle upon which it is formed and acts, he will much oblige

A SUBSCRIBER.

No. 72.—SUGAR FROM BEET-ROOT.

SIR,—In Dr. Willich's Lectures on Diet and Regimen, is an observation on the Beet-Root (I presume the Red is meant), "that it has been proved, that fourteen pounds weight of the root produced one pound of raw sugar, exceeding sweet, and without an intermixture of any other taste." If any of your numerous Readers and Correspondents would have the goodness to inform me, through the medium of your highly valuable Magazine, the proper process for obtaining this sugar, I shall feel very much obliged to them.—I am, Sir,

Your obedient servant, S. E.

P.S. In your Magazine, vol. I. p. 324, is an account of a Filtering Machine. Allow me to say, that I have had one constructed, and find it answers the purpose extremely well.

CORRESPONDENCE.

G. A. S. and S. R. are requested to send to our Publishers' for letters addressed to them.

Has J. W. received the letter which was transmitted as he directed?

We long to hear again from R. B.

We shall gladly avail ourselves of Aurum's Gleanings, but request that they may be of as practically useful a description as possible.

A Member rails at us unmercifully, for withholding the *other* letter *promised* by Dr. Birkbeck at the conclusion of his last (see p. 439, vol. II.) He should have first made sure that we had received such a letter. Dr. B. be it known, has *not done what he promised to do.* He brought a charge against us, or rather our informants, of being guilty of "fabrications and falsehoods;" he was invited, and stood pledged, to make good the charge; but though four weeks have since passed away, he has not favoured us with another word on the subject. We may now, we presume, take it for granted that Dr. B. finds he has asserted *what he cannot prove.*

A "Constant Reader," at Birmingham, is not, we dare say, the author of the book he praises so much; but we should like to see it, and judge for ourselves, before we recommend it to our readers.

We cannot open our pages to B.'s defence of Mr. Partington from an attack which did not originate there. And, moreover, we can never be satisfied, on any showing of the case, that it is right in the printer of a work to show the proofsheets of it to any other person than the author or editor.

We feel obliged to Mr. D. of Bath, for his valuable papers, and shall be happy to hear often from him. The letter which he expects will be forwarded through the channel he points out.

The Specimens alluded to by J. W. have not yet reached us.

Communications received from—A Staffordshire Land-drainer—No Architect—Kong Fou—W. H. E. Chemicus—P. T. R.—An Engineer—A Goldsmith's Apprentice—E. O.—Cæsar Borgia—R. N.—No Lapidary—P. D.—Steadfast—W. Smith—Monitor—Philo-Birkbeck (for whose paper we shall endeavour to find room in our forthcoming Supplement)—G. G.—S. Roberts—A Mechanic's Rib—A Man in the Moors—Tenor—G. Willis—A. G.—E. G. Petworth.

G. M. B. wishes to know where Mr. Ellington's Patent Lock, described in our 57th Number, is to be procured in town?

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by B. BENSLEY, Bolt-court, Fleet-street.

Mechanics' Magazine,

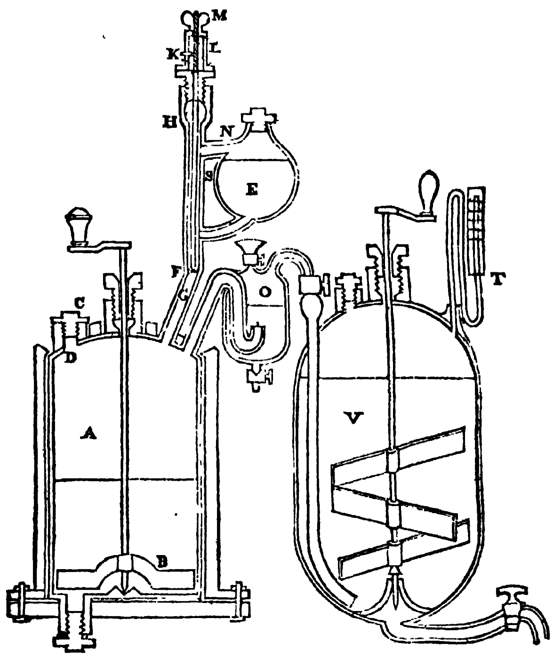
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

"The most valuable gift which the Hand of Science has ever yet offered to the Artisan." *Dr. Birkbeck.*

No. 61.] SATURDAY, OCTOBER 23, 1824. [Price 3*d*.

"Lord Bacon seems to limit Philosophy to the knowledge of things useful; recommending, above all, the study of Nature, and showing that no progress can be made therein but by collecting facts, and comparing experiments."—*Ferguson.*

CAMERON'S SODA WATER APPARATUS.



Sir,—In looking over some of the foregoing Numbers of your very useful Miscellany, I cannot help thinking it somewhat strange, that no answers are given to many of the useful inquiries; and knowing it to be your wish that your readers should answer them, in preference to any other way, I have taken the liberty of sending the following description of an Apparatus, invented by Mr. Charles Cameron, chemist, Glasgow, for combining carbonic acid gas with water, in the large way, in answer to "Medicus," p. 299, vol. i. which, from the ingenuity displayed in its construction, deserves, I think, to be better known.

The vessel A, in the Fig. containing about fifteen gallons, is formed of cast iron, six-eighths of an inch thick, and lined with sheet lead, of from eight to ten pounds per square foot, having an agitator, B, covered

with lead, working on the pivot below, and through the stuffing-box C. By the opening at D, the vessel is filled up to the dotted line with a mixture of whitening and water; the vessel E, containing two gallons, is formed of lead six-eighths of an inch thick, and is filled with sulphuric acid up to the dotted line; the acid is kept from falling down into A by the lead plug F, which is conically pointed, and fits into a corresponding conical opening in the lead pipe G; the plug moves straight up and down through the stuffing-box H, and is prevented from turning round by the pin K, which moves in a slit in the bridle L, the screw M being riveted loose into the top of the bridle; by this means the conical point of the plug is preserved from injury, as it is merely lifted out of the opening, and again pushed into it. This is more complicated than a common-formed glass or lead stop-cock, but neither of them will answer where a high pressure is applied. The pipe N, inserted into the top of the vessel E, and into the pipe S (*which encloses the plug*), preserves the equilibrium of pressure; so that the sulphuric acid rises no higher in the pipe S than in E, and consequently preserves the brass work of the stuffing-box. The intermediate vessel *o*, containing three gallons, is formed of thick lead, or cast iron lined with lead, and filled with water up to the dotted line. It is employed for retaining any of the sulphuric acid, in case it should be carried over by too strong an effervescence. The vessel V, containing sixteen gallons, may be formed either of copper tinned, with an agitator of the same metal, or of cast iron lined with lead, of from six to eight pound per square foot, and an agitator of maplewood, which gives no taste to the water. It is filled to the dotted line with water, and a proportional quantity of corbonate of soda, magnesia, or other substance, to be impregnated. T is a pressure-guage, containing mercury; in the Fig. it is placed on the top of the vessel, but it is more convenient to place it at a little distance, forming a communication by a pipe. The communicating pipes are lead, and their several uses are distinctly evident in the figure. When the vessels are filled, the mode of operation is extremely simple. On turning the nut M, the sulphuric acid is allowed to come in contact with the whitening; carbonic acid is necessarily disengaged, and in quantity and rapidity proportional to the quantity of sulphuric acid let down.

If the vessels were sufficiently capacious, 10,000 gallons of carbonic acid would be instantaneously produced; but by the alternate turning of the nut M, the sulphuric acid is allowed to fall down in small portions, which regulates the disengagement of the gas, and prevents too great an effervescence, as the gas is still accumulating. Having no way to escape, it passes over into the vessel V, and is there absorbed by the water. In this way, a pressure of from 20 to 30 atmospheres may be thrown into the vessels. It must, therefore, be obvious to every man of science, that if the vessel A were connected by a pipe with the valves of an engine somewhat similar to a steam engine, the vast pressure which can be so instantaneously produced, would raise and depress alternately the piston of a cylinder; that cylinder, too, would only require to be 1-20th the diameter of the steam cylinder to have an equivalent power, and the gas would be reduced to one atmosphere by its alternate escape at the opposite valves, no water being required for condensation; but, unfortunately, the expense of sulphuric acid, from the quantity required (*when the gas is allowed to escape*), presents an insurmountable obstacle as a substitute for the steam engine. Since Mr. Cameron discovered the power obtained by the production of carbonic acid, and put it into practice four years ago—a fact which was noticed in most of the journals and newspapers of the day—Sir H. Davy has turned his attention to the subject, and discovered that gases, at a high pressure, are powerfully acted upon by slight increments of temperature, and that the pressure is astonishingly augmented.

This circumstance affords ground to hope that an engine, constructed on the principles of the Rev. Mr. Sterling's air engine, may yet be

made to equal, and, in many cases, to supersede the steam engine.

The foregoing is the substance of a letter written to Dr. Brewster by the inventor. and published in the Edinburgh Philosophical Journal.

I am, Sir, &c.

JAMES MARSH.

Woolwich, Aug. 14,

IMPREGNATING FIXED OILS WITH ESSENTIAL AROMATIC OILS.

SIR,—The subjoined passage, respecting the art of impregnating fixed Oil with the essential Oils contained in aromatic Seeds and Barks, I have extracted from a small work on the Medical Topography of the Interior of Ceylon, by Mr. Marshall. Pray give it a place in your widely-circulated publication; some of the chemical readers of which will, perhaps, be kind enough to state, through the same channel, whether they consider Mr. Marshall's conjecture regarding the mode of compounding an "oil of holy ointment," as directed by Moses, Exodus xxx. 22, 24, possesses a feasible foundation.

F. P. C.

The Kandyans, as well as the natives of the Peninsula of India, are acquainted with the art of preparing compound and odoriferous oils, by impregnating fixed oils with the essential oil which is contained in aromatic seeds and barks. Oils of this kind are occasionally externally applied by the Kandyan Vederales. The process is as follows:—After the aromatic substances are coarsely powdered, they are put into an earthen vessel; the fixed oil is then added, and afterwards water, sufficient to cover the dry substances introduced; the vessel is put upon a fire, and the water made to boil; the boiling is continued until great part of the water is exhaled. During this process, the essential oil of the aromatics unites with the fixed oil, and impregnates it with the peculiar fragrance of the odoriferous seeds or barks used. Perhaps a knowledge of this fact may contribute to obviate the difficulty brought forward by the compilers of the French Encyclopedia, in regard to the cinnamon mentioned in Scripture. They aver, that the kinnamon of the Hebrews, mentioned in Exodus, chap. xxx. is not that of the Greeks and Romans, the modern cinnamon. Moses was ordered (see verses 22, 23, and 24) to take cinnamon, and other aromatic substances, of which he was to make "an oil of holy ointment," for the purpose of anointing the tabernacle, &c. The Encyclopedists profess to think, that the substance here designated by the term "kinnamon," must have been a gum, or an oil, rather than an odoriferous bark. Immediately after the enumeration of the aromatic substances, Moses is directed therewith to prepare "an oil of holy ointment," an ointment compound, after "the art of the apothecary, a holy anointing oil." The process for preparing the oil, or ointment, is not further stated. There is much probability that the holy oil was prepared in a manner approximating to the process above detailed.

"The following are the articles directed to be used by Moses in compounding the holy oil, or ointment:—

	Shekels.	Lbs.Troy
Myrrh.............	500, or about	18
Sweet cinnamon	250	9
Calamus (acorus calamus), Indian sweet rush............	250	9
Cassia.............	500	18
Olive oil, a hin	.. ....	10

"Water alone is wanted to complete the requisite substances needful for the above process.

"Should the process adopted by Moses for preparing perfumed oils have been similar to the one practised by the Indian doctors, some conjecture may be formed in regard to the nature of the composition designated in Scripture "an holy ointment," and a "holy anointing oil." It would appear, by the 23d and 24th verses, that cinnamon entered largely into the composition of the "holy anointing oil." This substance must, therefore, have been extremely precious. In ancient times, the trade in cinnamon was very circuitous; a circumstance which rendered the spice of great value in India."

FOUL APARTMENTS.

Hold your head as high as you can—when obliged to go into a place where the air is foul; foul air always sinking to the bottom of an apartment. Do not sit or lie down as you value your life.

GIVING CREDIT.

Avoid giving *long* credit, even to your best customers. A man who can pay easily will not thank you for the delay, and a slack or doubtful paymaster is not so valuable a customer that you need care about losing him. When you lose a bad paymaster from your books, you only lose the chance of losing your money.

MINUS.

SIR,—"Piger," in your last publication, has started a subject upon which I should very much like to have my reason convinced. It is certainly irrational, so far as my powers of comprehension go, to say that 3 times less than nothing, multiplied by 3 times less than nothing, should produce 9 whole numbers.

Suppose $a=8$, $-b=4$, according to this rule of Algebra (which, although I am sure it must be correct, I want to be convinced of), when multiplied by $-b$, produces thus:

$$\begin{array}{c} a-b \\ -b \\ \hline ab+bb=48. \end{array} \qquad \begin{array}{c} a-b \\ +b \\ \hline ab-bb=16. \end{array}$$

So that $a-b\times-b$ produces 48, and $a-b\times+b$ produces 16. There is some paradox in this, while $\frac{1}{2}\times\frac{1}{2}$ produces only $\frac{1}{4}$.

I have consulted several Treatises on Algebra without coming to a clear conclusion, and I hope some of your readers will do me the favour to illustrate this subject by an example. The Note, page 9, in Euler (Hewlet and Horner), is the most satisfactory xplanation that I have met with, but it certainly stops short before it has convinced me that $-3\times-3=+9$.

"We may illustrate the present subject in a different way, and show that the product of two negative quantities must be positive. 1st. Algebraic quantities may be considered as a series of numbers increasing in any ratio on each side of nothing to infinity. Let us assume a small part only of such a series for the present purpose, in which the ratio is unity, and let us multiply every term of it by -2.

$$\begin{array}{ccccccccccc} 5, & 4, & 3, & 2, & 1, & 0, & -1, & -2, & -3, & -4, & -5 \\ -2, & -2, & -2, & -2, & -2, & -2, & -2, & -2, & -2, & -2, & -2 \\ \hline -10, & -8, & -6, & -4, & -2, & 0 & +2, & +4, & +6, & +8, & +10. \end{array}$$

"Here, of course, we find the series inverted, and the ratio doubled. Further, in order to illustrate the subject, we may consider the ratio of a series of fractions between 1 and 0, as indefinitely small, till the last term being multiplied by -2, the product will be equal to 0. If, after this, the multiplier having passed the middle term, 0 be multiplied into any negative term, however small, between 0 and -1 on the other side of the series, the product, it is evident, must be positive, otherwise the series could not go on. Hence it appears that the taking of a negative quantity negatively destroys the very property of negation, and is the conversion of negative into positive numbers."

I am, Sir,
Your obedient servant,
RODERICK.

18th October, 1824.

BOOKS ON TURNING.

SIR,—Will you permit me, through the medium of your excellent work, to thank G. A. S. for having given me the first intimation of there being such a work on Eccentric Turning as Mr. Ibbetson's. I have just procured the volume from London, and think it a valuable book of instructions for beginners in eccentric turning. I hope we shall soon receive the information which your Correspondent G. A. S. has offered you, with the drawings of the chucks and tools which are used in the art of turning. There is another book which, perhaps, is not generally known, and which was published about a year after Mr. Ibbetson's, by Mr. Ritch, entitled "Specimens of the Art of Ornamental Turning, in Eccentric and Concentric Patterns;" sold by Skelton and Co. Southampton, and Whittaker, London. It contains six large plates, engraved by Lowry, of vases, temples, and pagodas, making handsome ornaments for chimney-pieces.

INQUIRY.—I shall be exceedingly obliged to any of your Correspondents, if they will inform me of the best method of staining or dying ivory red and black, such as chess-men, billiard-balls, &c. I have tried the receipts given in books, but the colours produced by them are not so beautiful as those produced by the manufacturers of brilliant balls.

I am, Sir, &c.
AN AMATEUR MECHANIC.

Falmouth.

ON THE STRENGTH OF LEATHER.

Sir,—In most of our elementary treatises on mechanics will be found tables of the strength of various substances, such as the different metals and various species of wood, and also of ropes and cords: but I am not aware of any good experiments on the Strength of Leather published in any of our books of general circulation; and as leather is an article of very extensive use, both in harness and in machinery, I consider it an object of some importance to be a little acquainted with its strength: for the benefit or amusement of your readers, I beg leave to send the result of some experiments on that subject.

I took a piece of good leather, manufactured from a cow's hide, such as is usually made into harness; length 13.30 inches, width 1.32, thickness 0.14, and weighing 1.2 ounces avoirdupoise. In order to ascertain the proportion of extension to the weight applied, I had two marks made on the strap, at six inches distance.

The extension of six inches by

120 lb.	was	0.7
170	—	0.9
220	—	1.0
270	—	1.1
320	—	1.24
370	—	1.44
420	—	1.55
470	—	1.65
520	—	1.70
600	—	2.00
680	—	broke.

The fracture was not at the centre of the strap, where the contraction was the greatest, but at one end, occasioned by a slight cut of the vice by which the strap was held.

The ratio of extension by half the breaking weight, expressing the length by unit, was 0.22, or nearly one inch for every 4 and ½ inches in length; the force of cohesion per square inch being 3981 lbs. and the modulus of cohesion equal to 10049 feet.

In a similar manner I tried other species of leather, and obtained the following results:

	Cohesion, lbs. per sq. inch.	Modulus of cohesion in feet.	Ratio of extension, by ½ breaking wt.
Calves skin - - - - - -	1890	5050	0.165
Sheep skin (basil) - - -	1610	5600	0.191
Horse skin (white) - - -	4000	11000	0.187
Horse skin (kip) - - -	3200	7000	
Horse skin (cordovan) - -	1680	3720	
Cow skin, as above - - -	3981	10049	0.22

To find the weight necessary to break or tear asunder any strap of leather, it is only necessary to ascertain the weight of one foot in length in lbs. and decimals, and multiply the modulus in feet by the weight so found; the product will be the greatest load the strap will bear, even when the leather is new, but not more than ⅓ or ¼ of the weight thus found should be trusted for any considerable time. B. Bevan.

CENTRE OF GYRATION.

Sir,—Dr. Olinthus Gregory, in his excellent Treatise on Practical Mechanics, art. 312, has inadvertently given an incorrect theorem for finding the *centre of gyration* of a cylindrical ring, and, unfortunately, this error has been copied into Morrat's very useful Introduction to Mechanics, page 381; and as the most essential part of a fly-wheel consists of such a ring, some of your practical readers may be a little puzzled by this error in books of such general utility. This notice, I trust, will be accepted, as it is intended to prevent practical errors, and not to depreciate the value of the above-mentioned publications.

Let R denote the distance from the centre of the fly-wheel to the outside of the rim, and r the distance from the centre to the inside of the same, then $\int \frac{R^4 - r^4}{2R^2 - 2r^2}$ = distance of the centre of gyration of the rim.

B. Bevan.

PRACTICAL GEOMETRY; BY T. S. DAVIES.

[A knowledge of Geometry is so essential to the greater part of our practical mechanics, that it would seem surprising so little has been done towards rendering that science a *popular* study. It becomes not a writer upon the same subject to censure his predecessors for the inadequacy of their works to effect such a desirable emulation amongst the artisans of our country—amongst that class of men upon whom the prosperity of this country mainly depends; nor, indeed, do I think that preceding writers deserve censure, for their object has not been so much to facilitate the acquisition of a Course of Problems which may be required in the practice of any particular trades, as to create a spirit of philosophical inquiry, and make a race of speculative geometers. However, so far as my limited acquaintance with the operative employments which require the aid of geometrical knowledge qualifies me for the task, I shall gladly so far contribute to my country's welfare in the publication of a course of problems for the use of that class of my countrymen. I had, indeed, some time ago, projected a course which should commence with the first principles of the science and the rudiments of lineal drawing, and collected a large stock of materials for the purposes of illustration; but, finding that the gentleman who signs G. A. S. has determined upon a similar undertaking, and feeling assured of his extensive learning as a geometer, and his intimate knowledge of the practice and applications of the science, I feel happy to give up the task into hands every way fitted for its most complete performance. My determination not to trespass upon the manorial rights of Mr. S., however, does not forbid me entering upon the geometry of solid bodies, their intersections, &c. This branch has scarcely been noticed by any man of science in this country, except Mr. Nicholson, with any practical intentions; I shall, therefore, endeavour to place it in so familiar a point of view as to be comprehended by those whose minds have not been very long initiated to such pursuits. Such is my aim; how far I succeed is not for me to even guess: all I can say is, that I have intended well, and done my best.]

No. I.

THE SPHERE AND CYLINDER.

PROB. I.—To transfer any given circle from the surface of a sphere, cone, or cylinder, to any flat surface.

Take any three points, A, B, C, in the given circle; and with the distances A B, B C, C A, construct the triangle A B C; then the circle described about this triangle is equal to the given circle upon the cone, sphere, or cylinder. (Fig. 1.)

Fig. 1.

Note 1.—It will be practically most convenient to take A B equal to B C.

Note 2.—I have only inserted a figure for the sphere, the other cases being so similar as to require no additional diagram.

Prob. II.—To find the pole of a *given* great circle of the sphere.

Def. 1.—It may be necessary here to remark, that the *pole* of a circle on the sphere is that point in which the compasses are set to describe such circle.

Def. 2.—A *great circle* is the *largest* circle that can be described upon the sphere, and always divides the sphere into two *equal* parts.

Def. 3.—The less circles of the sphere are any which can be drawn to lie wholly *on one* side of a great circle, or which, when transferred to a flat surface, have a less diameter than the great circle. Such are the parallels of latitude on a terrestrial globe.

Def. 4.—By the *plane radius* of a circle, we mean the radius of the transferred circle; and by *plane circle* we mean the tranferred circle.

Def. 5.—By the *describing radius* we mean that opening of the compasses which is required to describe any circle on the sphere. It is always greater than the PLANE radius.

Having premised these definitions, we now proceed to the construction of the problem.

Let D E (Fig. 2) be the plane great circle: divide the semicircle equally in F, then the opening F D is the describing radius. Fix one point of the compasses in any point, D, in the given great circle on the sphere, Fig. 3, and describe an arc (or, as it is more frequently called by workmen, an *arch*); remove now the foot of the compasses to another point, K, in the given great circle, and describe another arc, cutting the former in F. This point F is the pole required.

Fig. 2.

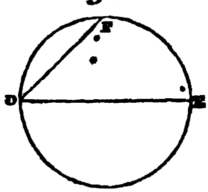
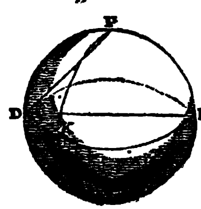
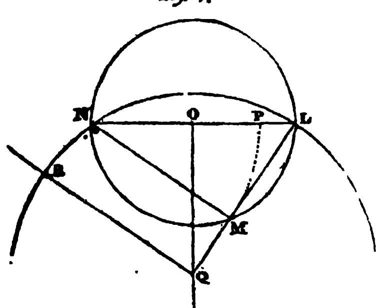


Fig. 3



Prob. III.—To find the great circle of any given sphere, and thence to describe that circle from any given point as a pole. (Fig. 4.)

Fig. 4.



With any describing radius taken at pleasure, draw a circle upon the sphere, and by Prob. I., tranfer it to a plane. Let N L be the describing radius, upon which, as a diameter, let the circle N M L be drawn.

With the plane radius of the same circle on the sphere, N P, describe the arc P M cutting the semicircle in M. From O, the centre of N L, draw the perpendicular O Q, and prolong L M to meet it in Q. Then Q L is the plane radius of the required great circle. Draw Q R parallel to M; N will cut the plane circle in R, so that R L is its describing radius.

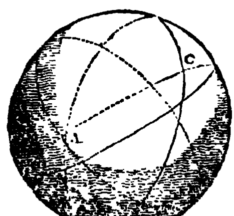
Note.—The mode given of performing the last operation is noticed here, principally to recommend the use of the parallel ruler to every one who has the least occasion for lineal drawing: it is cheap,* portable, and of more general use than any instrument whatever, except the compasses and sector.

PROB. IV.—To draw a great circle that shall pass through two given points on the sphere.

Let A B be the two given points. Find (Fig. 5) a great circle of the sphere (by Prob. III.), and with its describing radius, and the two given points as poles, describe arcs to cut each other in C. This point C is the pole of the great circle which passes through the given points.

* I think, as low as two shillings.

Fig. 5.

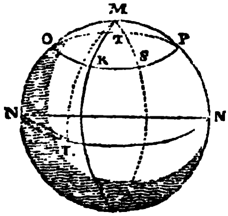


PROB. V.—To find the pole of a less circle of the sphere, and thence to draw another circle parallel to it. (Fig. 6.)

Find the plane radius of the given circle, and set it off successively from any point O in that circle, the distances O R, R S, S P, P T: through R T and O P describe great circles. Their intersection, M, is the pole required; from which any other circle, N N, being described, will be parallel to the given circle O P.

PROB. VI.—To draw a circle at any given distance from a given circle, and parallel to it. (Fig. 6.)

Fig. 6.



Draw (by Prob. V.) a great circle, N M N, through the pole of the given circle. From the sectoral scale of chords take the chord of the sum or difference of the given distance between the two circles, according as

the circle is to be drawn greater or less than the given circle. With this describing radius and the pole M, the required circle is to be drawn.

Note.—I have here taken for granted the knowledge of the principal uses of the sector; not that I suppose every workman, even though the most intelligent, acquainted with the instrument, but because it could not be conveniently introduced into the body of a paper like this. I have, however, drawn up a short and familiar treatise on the uses of a case of instruments, as well as of the different lines upon the slide rules, the quadrant, level, and theodolite, which I intend shortly to publish, though I have not yet determined in what form.

Prob. VII.—To draw a great circle upon the sphere, making a given angle with a given circle. (Fig. 6.)

If the point of intersection be not given, assume one, as M. Draw from M, as pole, a great circle, N L N. From the sectoral chords take N L, equal to the chord of the given angle. Through M L describe the great circle M L, and it is that which was required.

Note.—By this rule the *meridians* are traced upon a globe, and by the preceding problem the parallels of latitude are drawn.

I cannot pass over this problem without urging upon all who are engaged in tuition, the importance of making their pupils not only project maps, but also actually trace the principal lines upon a globe. The impression thus made would be much stronger than could possibly be made by mere plain maps. For the purpose of practice, they may use a ball of about five or six inches diameter, *painted white*, upon which to trace all the lines with black lead pencil: this may be washed off with soap and warm water, whenever it may be required. The same method, too, should be adopted in the study of spherical geometry; and I am confident—and my confidence is founded on long experience—that a boy would learn more geometry in a single month, by a process of this kind, than he could in twelve, by merely studying the projected lines. Indeed, had not our own eyes seen, our own ears heard it, we could not have believed that models are denied to the pupils in the *first places of education in this country*; and that while the reasoning faculties are all upon the stretch to discover the nature of an argument, the imagination is tortured to believe that a flat figure is a solid body, and that two unequal lines upon paper must be equal in the represented solid!

I should recommend my readers to procure such a ball as I mention, and also a cylinder, for the following problems. In short, whatever you reason concerning, whatever you study, always have the object actually before you; so that you can turn it in what direction you please, and feel certain of the equality or inequality of those parts you are considering.

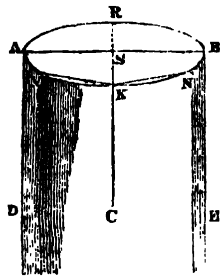
Were it not for fear of being tedious, I should even propose to allow pupils, instead of "doing maps," as a geographical exercise, to employ them to *construct globes*: but as the method of tracing the paper gores, so as to fit upon the sphere, could not be here introduced, I shall pass it over for the present. The thought is novel—by some it may be deemed wild; but the day will yet come when there will be no respectable school-establishment in which it shall not be introduced. These globes may be mounted at a small expense, and would be a source of pleasing remembrance to many a pupil long after he has entered upon the busy cares and anxieties of active life.

Prob. VIII.—To draw through a given point on the surface of a cylinder a line parallel to the axis, or, which is the same thing, in the direction of the length of the cylinder. (Fig. 7.)

Let A B E D be a perspective representation of the cylinder, and C the given point. With any convenient opening of the compasses, greater than C K, describe a circle cutting the circular end of the cylinder in M and N. Bisect the arc M N in K; then K C is the direction of the line whose position was required.

Note.—In this proposition it was supposed that the cylinder was "*squared*" at the end. Where this

Fig. 7.



operation cannot be performed, it will be requisite to find the position of the longest axis of an ellipse: but as such a case, I should think, could rarely occur, I have reserved the method of effecting it for that part of this series of problems which relates to the cone and its sections.

PROB. IX.—To trace a line, K L, upon a given cylinder *opposite* to a given line C K. (Figs. 7 and 8.)

Through the centre, *s*, of the circular end draw K R;* and imagine the back of the cylinder, in Fig. 7, turned towards you, as in Fig. 8 Take then any two points, *n m*, equidistant from R; from those points, as centres, with any convenient radius (the same in both instances), describe arcs cutting each other in L. R L is the position of the line required.

PROB. X.—From any point, C, on

Fig. 8.

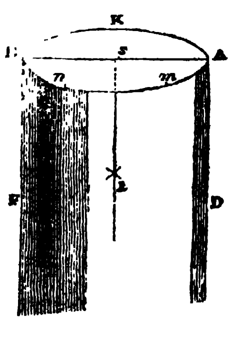
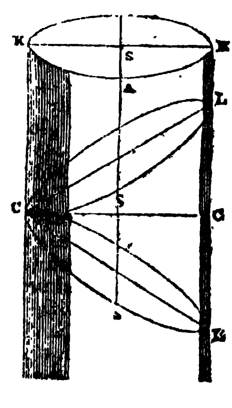


Fig. 9.



the surface of the cylinder, to find the position of the plane of section which shall make a given angle with the axis.

Let the cylinder now be so turned that K C, R L, shall occupy the positions denoted in Fig. 9. Find C K, K R, R L, as in the last problem; make R C equal to K C; and C L, or

* The Engraver has omitted the letter R in Fig. 8; but the reader will readily perceive where it should have been inserted (between *n* and *m*).—EDIT.

CL′ (as the case may require), equal o the sectoral tangent of that angle which would make the given angle equal to a quadrant.

If now BA be perpendicular to KR and passing through s, and AS be drawn parallel to the axis (Pr. 8.), in which AS, or A*s* (as the case may require), is taken equal to half the sum of KC and RL (or of KC and RL′, when the case requires it), we get S or *s*, the third point, which, with L and C, determine the plane of section required.

Note 1.—When the angle which the plane makes with the axis is half a right angle, the line CL, or CL′, is equal to CC; a remark which will be used in the next paper, on the *cycloid*.

Note 2.—The chalk string held at CL, or CL′, will mark the curve CsL, or CSL′, upon the cylinder.

Having thus performed the principal problems which can occur in the practical geometry of the sphere and cylinder, and that without the aid of any inaccessible points or lines, I shall close the present paper by remarking, that in my future communications I shall aim at the simplicity, perspicuity, and illustration, which ought ever to be the object of him who writes for the purposes of instruction.

Bath, October 6.

CLOCK-MAKING.

Sir,—The following communication is copied from the "Gentleman's Magazine" of the year 1757; should you think it likely to forward the views of ingenious Clock-makers, you will oblige me by giving it a place in the Mechanics' Magazine.

I am, Sir, &c. S. D.

Skinner-street, Snow-hill.

"A Clock, of a new construction, invented and presented to the Royal Academy of Sciences at Paris, by M. le Roy the Younger, Member of the Royal Academy at Angers. It consists of two wheels only, one for the movement, and the other for the striking, besides the rocket, which forms the scaping, and the detent and lifter of the hammer; this is all that is contained in the frame The rocket is alternately moved upwards by the action of the wheel which carries the weight, and downwards by its own weight. When the action of this wheel ceases, which it does every half minute, the pendulum acts at freedom for thirty seconds together, and the lost motion is restored at the one-and-thirtieth second, by one of the pins fixed on the moving wheel, which then bears on an inclined plane fixed to the verge of the pendulum. This pendulum, by means of another piece fixed to its verge, serves likewise to regulate the striking part. This clock appears to be equally simple and ingenious, and sufficient to do honour to the talents and capacity of its author."

ANOTHER EXTRACT FROM THE SAME WORK.

An Equation Clock, proposed by M. Berthored, clock-maker, at Paris. By an extremely simple mechanism, the striking part moves on the annual wheel one tooth a day, and two on the 28th of February, when it is not a Leap-Year. The equation is shown by an absolutely new method. This construction has been thought very ingenious, and more simple than any hitherto proposed for the same effects.

PROBLEM FOR MILLWRIGHTS.

Sir,—Some of your Correspondents have amused us lately with the revolutions and calculations of Cog Wheels, the reading of which has induced me to send you the following Question, in hopes that some one or other of your readers will give me an answer to it:—

There are to be four spur wheels; one of them is to have 99 cogs, and the other three to have 100 cogs each; they are all to work at the same time and into each other; and I want to know how they must be placed, so that two of them shall make 100 revolutions each, in the same time that a third wheel makes but one revolution: the solver may do what he chooses with the fourth wheel, only keep it amongst the rest The thing can be done, and, when properly constructed, will form a very powerful and useful machine.

In a short time, I intend to answer the question put to me in your 56th Number, by William Andrews.

I am, Sir, &c.

J. R. (not J. K.) A Man in the Moors.

THE RULES FOR CALCULATING THE PRICE OF TIMBER.

SIR,—Fearing that the observations of your Correspondent, T. C. B. of Winchester, may induce some of your readers to suppose the rules given on page 13, vol. III. of your valuable Miscellany incorrect, I wish to inform him, that deals are sold by the long hundred, viz. 120; as, indeed, he might have found by trying the example.

I am, Sir, &c. J. S.

[Communications to the same effect have been received from J. B.,—R.,—E. Crouch, and "Try Again."—ED.]

MR. NEWTON'S LECTURES ON ASTRONOMY.

SIR,—Reading in a morning paper an account of a Lecture delivered by Mr. Newton at the London Mechanics' Institution, on Astronomy, I perceive he took occasion, in the course of his address, to illustrate his remarks by comparing the sun's magnitude to the dome of St. Paul's, and reducing the sizes and distances of the planets to the relative proportions. I think he should have had the candour to have alluded to the work whence he borrowed his idea.* The statement was, perhaps, sufficiently correct for his purpose; but the calculation was erroneous in one main point, viz.—supposing the earth to be ten inches in diameter, the dome would be very nearly twice the circumference of the sun.—I am, Sir, &c. R. W.

Oct. 13th, 1824.

[The work or Table referred to by our Correspondent, and which does great credit to his ingenuity, shews, in a very perspicuous manner, the relative magnitudes of the sun, the moon, and the planets; also the relative distances of the planets from the sun, and the moon from the earth, together with their orbits and periods of revolution; assuming the magnitude of the earth to be that of a globe twelve inches in diameter. It appears by this Table, that, supposing the earth to be the size of a 12-inch globe, its distance from the sun would be 2 mil. 2 fur. 42 yds. 2 ft.: according to this calculation, the sun would be something larger than half the size of the dome of St. Paul's, taken as the half of a sphere, and the earth in its orbit would move over Stepney-green, Bethnal-green, Kingsland-crescent, Canonbury-house, Pancras Workhouse, the Regent's Circus, Grosvenor-square, Constitution-hill, Vauxhall-bridge, Kennington Common, Walworth Chapel, Kent-road, north of Sussex-place; Paradise-row, Rotherhithe; Coal Stairs, Shadwell; and thence to Stepney-green; which journey would be performed in 1 ho. 6 min 29 sec. The moon would revolve round the earth during this period of its revolution, so as to be in conjunction with the sun, rather more than 12 times, at a distance of 30 ft. 5 in.—ED.]

* The work alluded to is "The Solar System," arranged in a new and familiar manner, by R. W. published by John Souter, about ten weeks ago.

ON HEAT AND STEAM.

SIR,—I beg to hazard a few opinions on Steam, and the probability of preventing Explosion of Boilers; but holding anti-Newtonian opinions respecting attraction and heat, I shall confine myself to common-place language as much as possible, and, to avoid prolixity, by frequent elucidations, make a few preliminary remarks.

First.—Attraction, as I conceive, has no existence in nature: there is no proof of its being the cause of a single phenomenon. All phenomena consist in change of place of particles or bodies; and cohesion, as well as dissolution, is but the effects of pressure, according as this takes place on the outside of a body or within it.

Secondly.—I hold that there is no such thing as a hot body: the particles of matter, being unchangeable and inert, are always in the same state, and perfectly incapable of acting on each other, or of suffering change, except as relates to situation. Heat is the state of feeling; to provoke which it is not requisite that matter should be hot, any more than that matter should be coloured or noisy, in order that colour or sound should be perceived. Heat is a mental effect only, as much as colour or sound.

Thirdly.—Fire does not communicate any thing to bodies; on the contrary, it causes them to suffer loss. Thus linen cloth, paper, coal, and wood, are deprived of some of their elementary particles by fire, and the loss is sensible. In like manner, when indecomposable substances are in contact with fire, they lose only electric matter; for fire can act but uniformly. The cause of expansion, which fire is necessary to the production of, it is unimportant to mention here; besides, the proof requires a much extended series of illustrations.

Fourthly.—Fire is as inactive as any other species of matter. The elements

it consists of are common to all manner of bodies, and from its increase by the addition of what is not fire, it is obvious that it consists of common matter in a state of mixture, so as to favour the dissolution or decomposition of whatever is in contact with it, by serving as a minus pressure. Fire effects reduction of a body, by reason of the medium which attends it being such that the interstices between its particles serve as so many vacuums or recipients for whatever may be pushed into them, and the effects of the general compression which all things are under are the cause of transfer or change of place of the particles of bodies in the direction of fire.

From these premises there appears no office for attraction to perform, to pass over all the disservice it would be productive of.

Water suffers loss by fire of electric matter, which is visible on the bottom of a bright vessel in the form of air bubbles. These bubbles ascend only as the water cools, and then do not escape: were they air, or any thing communicated by fire, after penetrating a plate of metal, they could not be resisted by the water so as to be kept beneath it. *Fire takes*, and this is the matter it takes from water; and expansion follows when steam is thrown off.

The question then is, *could not water be de-electrized without fire, so as to promote its expansion?* The thing is actually done by nature in all cases of congelation, wherein the expansive effects are far superior to any produced by steam. In the next place, steam is not water; it is less than water, by what fire takes from water in order to produce it; and, as the expansive power of steam is lessened or increased, according as the medium it enters is colder or hotter than boiling water, by which it acquires, in the first instance, what fire took, and becomes more deficient of the same in the second, might not steam be still further de-electrized, by means of *the machine and conductors*, so as to put it in a state of much greater expansion than what it is dependent on fire for? The mode to increase the power of steam is, manifestly, by following up the means which produced it, namely, by de-electrization: and could the same be effected on cold water or on steam, the expense of fuel, it is presumable, would be considerably reduced; but, with cold water, the *power* would be immense, and the boiler (calling the water vessel by that name) could never wear out; explosion, too, could never result from decay of material.

Under the present system of working steam engines by fire, I would propose, whether a species of self-regulation might not be introduced, so as to conduct electric matter to and from the water in the boiler, or to and from the steam in the dome of the boiler, so as to maintain the power always equable, and thereby get rid of safety valves, on which alone it is erroneously considered prevention from explosion depends?

I would next suggest, whether beneficial effects might not be obtained by conducting from the boiler the stratum electric matter which accumulates the bottom beneath the water? The formation of steam depending on the abstraction, by fire, of electric matter from water, it may be inferred that the more speedy removal of such would promote the generating of steam faster than by fire alone, and thereby lessen the consumption of coal. This increase of quantity of steam would render hazardous high pressure unnecessary. The stratum of electric matter, by keeping the water from touching the bottom of the boiler, may be productive of the great decay the metal is subject to. It may also promote the formation of the solid matter in the boiler, which, with the metal bottom, is an additional hindrance to its escape towards the fire.

In conclusion, it is to be remembered that, according as electric matter is to be conducted to or from the boiling water, and sought after by self-acting means, the medium into which the conductor externally is placed, should be cold or hot. Cold water imparts, hot water abstracts, electric matter. Towards perfecting the foregoing speculations, I would recommend, that instead of being deluded by what are called attractions and chemical properties of matter, none of which, in my opinion, matter possesses, all change should be looked upon as to be effected by the *opposite* of what is to be changed—heat by cold, and electricity by its opposite.

T. H. Pasley.

Chatham Dock Yard.

DOUBTS *versus* DIFFICULTIES.

Sir,—I do not admit the principle which J. Y. assumes (p. 60, vol. II.), that water increases friction and oil diminishes it (vide No. 60, p. 60). I contend that they both diminish friction. In large machines water is frequently used to lubricate the axles of wheels, as being less expensive than oil, and I have always understood it answered the purpose extremely well. Neither can I admit that an edge-tool is *set* quicker upon a Turkey stone with oil than with water; but in either case the abrasion must evidently be produced by a mechanical and not by a chemical action. The difficulty in using water

with a Turkey stone is, that it cannot be kept upon the face of the stone; and if J. Y. will immerse a stone that has never been used with oil, in water just to cover it, and then apply an edge-tool, he will find that it will be set very expeditiously. It has, however, been lately ascertained that soap and water are better than either oil or water, as being less expensive, more efficacious, and more cleanly.

Yours, &c. A.

One Difficulty solved.

SIR,—In answer to the second inquiry of J. Y. (p. 60), why a screw-nail is screwed home much easier with a *long* than with a *short* screw-driver, the handles of both being alike? I apprehend that it may arise from this cause—that the *perpendicularity* of the tool is much more easily ascertained and preserved during the operation in one case than in the other.

Yours, &c. A.

EXPANSION OF STEAM.

SIR,—I beg to make, through the medium of your pages, a few observations on a Table of the Expansive Force of Steam, by Mr. Arthur Woolfe, which I find quoted, with apparent approbation, in "Stuart's History of the Steam Engine," p. 168.

Theory would seem to assign the ratio of the mechanical action of steam to be equal to the power it exerted in a more dense state, when divided by any number of times it may have been allowed to expand from such state. For example, if a cubic foot of the elastic force of 30lbs. per inch be allowed to expand to double its volume, it would then be capable of exerting a force equal to 15lbs. per inch, and if into a space of three cubic feet, it would be only equal to 10lbs. per inch.

It follows, then, that if we multiply 1800, the number of times that steam is considered to be capable of expanding, and to have an elastic force equal to that of the atmosphere, or 15lbs., the atmospheric pressure per inch, the sum will be the elastic force of water per inch, when heated sufficiently to flash instantaneously into steam, to any degree of expansion. Or if 27,000lbs. the sum produced, be divided by the number of expansions it has undergone, the result will be the force it is then capable of exerting.

We know that arithmetical proportions of the mechanical action of steam are obtained by the addition of degrees of heat decreasing in number, as it increases in intensity; therefore, if we were to condense two cubic feet, of 15lbs. per inch, into the space of one, and if more free heat be given out by it than is indicated by steam of 30lbs., it follows that its elastic force would be increased by such excess to a greater degree than is assigned by the above theory; and, on the contrary, the decrease of power by expansion would exceed the proportion of its increase in bulk. But to what extent these increments of increase or decrease exist, and, consequently, what the absolute mechanical action of heated water, or concentrated steam, really is, above what I have laid down, experiment alone can determine; yet, perhaps, the greatest difficulty is, to conceive how steam (say of 212°), compressed into one-half its volume, should indicate no more, or probably but little more, than 250°, when we may reasonably suppose the atoms of heat in contact with the thermometer to be double the former in number.

From what has been said, the fallacy of the elastic force of the expansions given by Mr. Woolfe may easily be perceived; as, according to them, the mechanical action in effect becomes greater from expansion, or increased rarity. I would fain believe that this statement has been drawn erroneously by some intermediate hand; if not, we may very reasonably question whether the results are really, as stated, the produce of "experiment."

It is stated, "that he has ascertained by experiment, that steam, of an elasticity greater than that of the atmosphere, is capable of expanding itself as many times as its pressure is above that of the atmosphere in pounds weight, *and still to be equal to the air's pressure.*" Suppose, for ex-

ample, we take steam of an elasticity equal to 16lbs. per inch, or 1lb. on the safety valve, we are informed that it will expand into a double bulk, and then be equal to 15lbs. per inch. Now, if this be the fact, what dolts must our engineers be, to use steam of 16lbs. per inch, when, by sacrificing 1lb. of elastic force, a double quantity of steam is obtained, or a power in effect equivalent to 30lbs. per inch?

As atmospheric pressure has no possible influence or control over the rate of expansion, it being merely a standard by which and from whence this power is usually calculated, we will take steam of 18lbs. per inch, and allow that to expand into a double volume. The effect must be precisely the same as the first, and hence the force of this expansion will be 17lb. per inch, or, in mechanical effect, equal to 34lbs. per inch. Granting this to be correct for a moment, while the principle is applied to a triple expansion, which again is said to give but 2lbs. less in mechanical force, or 16lbs. per inch, from whence an aggregate of power is consequently obtained equal in effect to 48lbs. per inch, by a sacrifice of only 2lbs. of elasticity. This, however, is evidently at variance with the two first examples, and that it cannot be the fact, requires no very deep penetration to discover; for if a cubic foot of steam will expand into two, with a loss in elasticity of only 1 lb. per inch, does it not follow that those two will expand into force, and only suffer a diminution to the same amount? Obviously they must, if this principle be correct; for whether we take a cubic foot of 18, 17, or 16lbs. per inch, or of any other elastic force, and allow it to expand into two cubic feet, 1 lb. only per inch, more or less, will be lost of its elasticity; and, therefore, if we take steam which has been allowed to expand once, and by it reduced from 18lbs. to 17lbs. per inch, that one cubic foot will again, on the same principle, expand into two, with only 1 lb. loss, as in the former examples. Of what density steam may be used, it can only be regarded as one of a series of expansions emanating from its orignal state, water; and it matters not to which of such series the principle is applied.

Thus, then, according to Mr. Woolfe, the law of expansion, and its mechanical force, is a decrease in elasticity, or mechanical action, only 1 lb. per inch to double its increase by expansion, and is represented as follows:—

	lbs. pr. in.	ft.	lbs.	
If the elastic force per inch be	18	1	18	mechanical action in effect.
	17	2	34	
	16	4	64	
	15	8	120	

Such a law is opposed to every known principle both of matter and motion; and such an absurdity appearing in print says as little for our theoretical, as it does for our practical knowledge.

I am, Sir, &c. W. G.

GERMAN POLISH.

SIR,—You have given, in your pages, receipts for French Polish and Roman Polish, permit me to add one for German Polish, which I have heard spoken of very highly.

I am, Sir, &c. H.

Melt an ounce of black rosin, and a quarter of a pound of yellow wax, in an earthen pipkin, and pour in, by degrees, two ounces of spirits of turpentine: when the whole is well incorporated, put it in an earthen jar, and keep it close covered for use. When you use it, spread a little of it on the furniture with a woollen cloth, and rub it well in. In a few days the polish will be as hard and as bright as varnish.

FALSE WEIGHTS

The most common mode of cheating, by means of false weights, is to have the balance so constructed, that when both scales are empty they shall hang even, but, at the same

time, have one arm of the balance longer than the other; then, although the weights used may be just, yet, being put into the scale suspended from the short arm, much less than an equal weight will bring the balance even. The best mode of detecting the deceit is to weigh the articles alternately in both scales, when the difference in the results will be immediately manifest.

INQUIRIES.

NO. 73.—SHARPING KNIVES.

Sir,—Some of your numerous readers would oblige me (and, I am satisfied, very many others at the same time) with a few *plain* and *simple* directions for giving an Edge to a common Pen-knife. The work, *in nine cases out of ten, is done over and over again;* and although I am told that nothing but habit and constant practice will effect this, I do not entertain a doubt but that many of your readers, *if so disposed*, have the talent to demonstrate how the thing *is done*, and *may be done* by others, upon system, of which they might, at the same time, explain the *rationale*.

I am, Sir, &c.

Scriba.

NO. 74.—TELESCOPES.

Sir,—I beg permission, through the medium of your Magazine, to ask a few questions concerning Telescopes, which I hope that some of your Correspondents will be so kind as to answer.

I wish particularly to know what is the best method for Casting and Polishing Specula for Reflecting Telescopes. I have long had an idea of attempting to make myself one, as I cannot afford to give twenty guineas, which I find is the price of such as I should like to have. I have seen Edwards's directions, but I apprehend that improvements must have been made since his time, and that there is a more simple method, and one that comes more within the reach of such men as myself. The particulars of which I am in want are—1st. The method of making the flask and moulding the patterns. 2d. The manner of mixing the metals and the proportions of each. 3d. The process of casting. 4th. What tools are *absolutely necessary* for grinding and polishing the specula. And, 5th. The cost of the materials, separately stated. I should also like to see it explained why a parabolic curve is necessary for the large speculum, and why a spherical curve would not do as well: diagrams, in these instances, would be desirable.

John Barton.

P.S. I should very much like to see some observations on the comparative goodness of Refracting and Reflecting Telescopes, and what is the most desirable size of such for *general* purposes.

ANSWER TO INQUIRY.

No. 59.—WATT'S STEAM ENGINES.

An "Amateur" is informed he may purchase Working Models of Watt's Single and Double Engines, and a Treatise on ditto, and know price and particulars, by addressing a line (post paid) to Mr. Knight, Mr. Cooper's, Union-street, Birmingham.

CORRESPONDENCE.

Tyro + Piger—3, in our next.

A letter addressed to A. B. as alluded to in Nos. 13 or 15, "on Propelling Boats," lies at our publishers'.

We have not come to a decision as to the insertion of Nrubkcall Caasi's paper, but shall look over it again.

Mr. Ellington informs us, that his Lock, referred to in the last Number, is to be procured at the Balloon Ironmongery Warehouse, Bishopsgate-street.

Communications received from—F. Fleet (omitted to be acknowledged some weeks ago)—A Cambrian—Samuel Mainley—A Goldsmith's Apprentice—Timothy Daub—M.—Legis—Main Spring—A. G.—C. C—Handsaw—J. Grant—Norman—Q in the Corner—D. B. G. S.—Minor.

Communications (post paid) to be addressed to the Editor, at the Publishers, KNIGHT and LACEY, 55, Paternoster-row, London.
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Mechanics' Magazine,

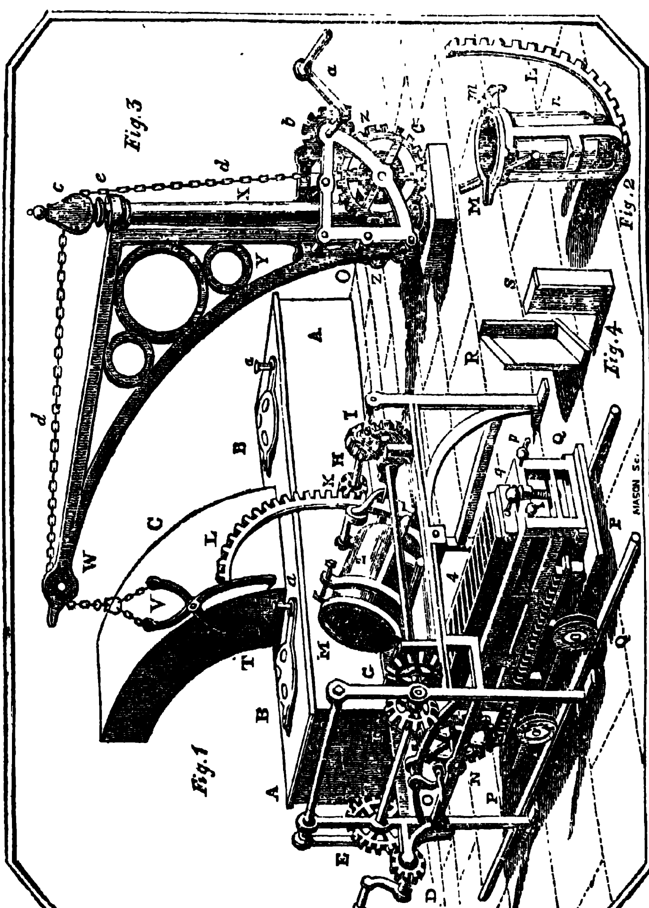
MUSEUM, REGISTER, JOURNAL, AND GAZETTE

"The most valuable gift which the Hand of Science has ever yet offered to the Artisan." *Dr. Birkbeck.*

No. 62.] SATURDAY, OCTOBER 30, 1824. [Price 3*d.*

—— "The charm dissolves apace;
And as the morning steals upon the night,
Melting the darkness, so their rising senses
Begin to chase the ignorant fumes that mantle
Their clearer reason." *Shakspeare.*

PROCESS OF COINING AT THE ROYAL MINT.



PROCESS OF COINING AT THE ROYAL MINT.

The process of melting Silver, now practised at the Royal Mint, is a recent invention, and a very great improvement. The usual mode was to melt it in black lead pots, and a considerable coinage of tokens for the Bank of Ireland was performed with the meltings done in this way. The importations being entirely Spanish dollars, and the tokens of that standard, the melter could easily melt them in quantities of 60lbs. Troy, which was done. The inconvenience of this mode was severely felt, because ingots of silver of various qualities could not be imported for coinage, from the difficulty of not being able to blend several together in one pot, so as to produce the proper standard of our money. So sensible was Government of this imperfection in the Mint, that, in the year 1777, Mr. Alchorne, then Master's Assay-Master, was sent to visit the Mints of Paris, Rouen, Lille, and Bruxelles, and to collect information as to the arts of coining practised in those mints, and particularly the art of melting silver in large quantities. Mr. Alchorne's intimate knowledge of the English Mint, together with his various and extensive knowledge as a practical chemist, well fitted him for the important undertaking; and his observations on the coin and coinage of France and Flanders are exceedingly creditable to his judgment and knowledge.

It is worthy of remark, that it is on record in the books of the Mint, that, in the recoinage of William III. the pots of silver weighed 400lbs. Troy and upwards; but every trace as to how this quantity of silver was melted is completely lost; and it is only conjectured that it was done in pots made of wrought iron. But not a vestige of a melting furnace, fitted for such a purpose, is to be found in the Tower, nor a single record of the method practised.

In the year 1758, some trials for melting silver in wrought iron pots took place, by means of a blast-furnace; but they were found so laborious, inconvenient, and profitless, as to cause the process to be abandoned.

In 1787, when some silver was imported into the Mint for coinage, new experiments were made by the late Mr. Morrison, then Deputy-Master and Worker, and who conducted the meltings. A blast-furnace was again tried and abandoned. He next attempted to melt the silver in large black lead pots, containing from 100 to 120lbs. Troy; but the repeated breaking of the pots, although it was attempted to guard them by outside luting, proved a great interruption to the business, and serious loss to the melter. Trial, indeed, was made with cast iron pots, but these were found subject to melt, and the iron got mixed with the silver. The work too was continually stopped by the King's Assayer, in consequence of the metal not being of the proper standard, it being always refined by the process of melting, and lading it with ladles from the pot.

Independently of these considerations, very great difficulty arose at the office in arranging the potting previous to the operation. The practice pursued at the Mint (in order to reduce the metal to standard), of combining and blending the various ingots of better and inferior qualities, adding what little portion of alloy or fine metal that might be necessary to obtain accuracy, rendered it impossible, where the ingots weighed from 60 to 80lbs. Troy, to pot them of a weight not exceeding 100lbs. Troy. It therefore became necessary, in the first place, to reduce the larger description of ingots to a smaller size by melting, and these were again weighed in the office of receipt. Hence a double operation took place, occasioning additional labour, waste, and expense to the melter, and requiring extraordinary trouble and attendance on the part of the office. It was very obvious that this mode of conducting the silver meltings was extremely defective, and was in consequence abandoned.

The next experiments made were with a reverberatory furnace, built

after the model of those used in the Lille Mint. But no better success attended these trials, and the process was, as in former cases, abandoned. The imperfection here arose from the great refinement of the silver in the melting, by the oxidation of the alloy, and which the usage of the British Mint does not allow the melter to supply, as in the French Mints. In the French Mints, as soon as the silver is in fusion, a sample is taken out and assayed, and copper is added in the proportion to the refinement of the melted silver (which is kept in fusion while the assay is making); the whole is well stirred, and immediately laded out and cast into bars.

In the years 1795 and 1798, several farther trials were made by the late Mr. Morrison, who was indefatigable in his endeavours to perfect his department, with a view to attain the object so much desired—that of melting large quantities of silver at once, without producing so much waste and refinement in the metal. In these experiments he tried three furnaces, each of a different construction; and though he was much nearer his point, there was still an imperfection, arising from the mode of dipping out the metal from the pot with ladles, which chilled the metal, and rendered the process extremely laborious and tedious.

No new experiments were made until the year 1801. Mr. Morrison, having died in 1803, was succeeded by his son in the office of Deputy-Master and Worker of the Mint. The extreme scarcity and defective state of the silver coin at this time, arising from the defective state of the melting department, urged Mr. Morrison to renew the experiments of his father. In following these experiments, Mr. Morrison had in view the construction of a furnace adapted for the use of cast iron pots—the use of pots of a size capable of melting from 400 to 500lbs. Troy, at one charge—the adaption of such machinery as would supersede the clumsy and wasteful process of lading the silver from the pots when melted—and, lastly, the introduction of the use of moulds made of cast iron, in place of those then used in the Mint, and which were made of sand

In all these objects Mr. Morrison, highly to his credit, perfectly succeeded; and the silver melting department of the New Mint was constructed according to the furnace first used in the experiments which led to such a satisfactory result. The whole has been in use since 1811, and the department is capable of melting, with ease, 10,000lbs. Troy of silver daily; as was done for several months during the late recoinage (1817).

Having formerly (p. 283, vol. i.) given a description of the apparatus for flatting, rolling, or laminating the silver, we shall now proceed to describe the machinery and furnaces of the silver melting department.

The Engraving prefixed to this article exhibits a perspective view of the Machine for casting Ingots of Silver.

Fig. 1. A A are the furnaces in which the metal is melted. These are the air-furnaces, built of fire-brick, in the usual manner of melting-furnaces; but, to render them more durable, the brick-work is cased in cast iron plates, which are put together with screws. B B are the covers to the furnace; they are held down to the top plate of the furnaces by a single screw-pin for each; and on the opposite side of the cover, a handle *a* is fixed. By pushing this handle. the cover is moved sideways upon its centre pin, so as to remove it from the furnace mouth. A roller is fitted to the cover, to run upon the top plate, and render the motion easy.

The interior figure of each furnace is circular, 30 inches deep, and 21 in diameter; the bottom is a grate of cast iron bars (each bar being moveable) to admit the air. Upon the grate is placed a pedestal or stand of cast iron, of a concave shape, covered an inch thick with coke or charcoal dust, and upon which the pot is placed in which the silver is melted. The pedestal is nearly two inches thick, and is fully two inches broader in its diameter than the pot, the object of which is to protect the hip of the pot from the very high heat which the current of air, ascending through the grate, when the furnace is at work, creates, and which would otherwise melt the pot. This precaution is essentially necessary, from the pedestal raising the pot so considerably above the grate, and from its being entirely surrounded by the fire in the furnace. If the furnace, however, is properly managed, there is no risk of melting the pot. On the top or mouth of the pot is placed a muffle, which is a ring of cast iron, six inches deep, made

to fit neatly into the mouth of the pot; the use of this muffle is similar to that used in melting gold, to give a greater depth of fuel in the furnace than the mere length of the pot, and which gives a greater degree of perfection to the process. The muffle is also extremely convenient, by giving a depth to the pot, if we may so speak, which enables ingots of silver to be charged, which are longer than the depth of the interior of the pot. The top of the ring or muffle is covered with a plate of cast iron, to prevent the fuel from falling into the pot, and secure the metal from the action of the atmospheric air when in fusion. Each furnace has a flue nine inches wide and six inches deep. The flue is four inches from the top of the furnace, and proceeds in a horizontal direction, and extends to the flue C, which is nine inches square, and is carried up in a sloping direction to the stack or chimney, which is 45 feet high from the grate of the furnace.

When the furnace doors, B B, are closed, the current of air which enters at the grate ascends through the body of the furnace, and causes the fuel, which is coke, and which surrounds the melting pot, to burn very intensely. The degree of heat wanted, however, is very nicely regulated by a damper, which is fixed in the flue of each furnace, and exactly fitting the square of the flue, so that any portion of draught can be given to the furnace that may be wanted. The damper is a plate of wrought iron, fixed in a frame, and is easily moved in and out, so as to increase or diminish the size of the flue. It is fixed in the brick-work of the sloping flue C, about 18 inches above the top of the furnace. The furnace doors B have small holes in them to look into the furnace; these are closed by stoppers or plugs of cast iron.

When the furnace is put to work, it is lighted by some ignited charcoal being put upon the grate, and around the pot (for the pot is always in its place before the fire is lighted); upon the charcoal about three inches deep of coke is put; the door B is shut, and the damper is pulled out about two inches. When the coke is ignited, a similar quantity is put on, and so continued until the furnace is filled with ignited coke. The object of this precaution is to prevent the cracking of the cast iron pot by being too suddenly heated; and it is generally about two hours before the pot can be brought to a charging heat, to do it with perfect safety. Before the silver is charged, the pot is heated a bright red; it is then examined, to see if it has cracked in bringing up, as it is technically called. This is done by placing a cold iron tool of considerable thickness in the centre of the pot, which immediately renders any crack visible to the eye. When satisfied that the pot is sound, the silver is charged into the pot. With the silver is put into the pot, a small quantity of coarsely grained charcoal powder, which coats the inner surface of the pot, and prevents the silver from adhering to it. When the silver is brought to the fusing point, the quantity of charcoal is increased, until it is nearly half an inch deep on the surface of the silver, and which keeps the silver as much as possible from the action of the common air, and prevents that destruction of the alloy which would otherwise cause a considerable refinement in the metal. When the silver is completely and properly melted, it is well stirred with an iron stirrer, so as to make the whole mass of one uniform standard quality. The pot is then taken out of the furnace by the crane, and conveyed to the pouring machine, by which its contents are poured into the ingot moulds.

Fig. 3 is the crane. It is supported by a strong column of cast iron, X, which is firmly fixed in masonry beneath the floor. The gibbet of the crane, marked WY, is cast in one piece; it has a collar at *e*, which fits upon a pivot formed at the upper end of the column X. At the lower part of the gib is a collar which embraces the column near its base. On these two supports the gib turns freely round, so that its extremity W may be placed over either of the furnaces BB. The wheel-work of the crane is supported in two frames *z z*, which are fixed to the gib by three bolts; it consists of a cog-wheel *c*, upon the end of the barrel, on which the chain winds, and a pinion *b*, which gives motion to the cog-wheel. The axis of the pinion has a winch or handle (*a*) at each end to turn it round. The chain *d*, from the barrel, is carried up over the pulley at *e*, which is fitted in a part of the gib immediately over the pivot at the top of the column X. The chain then passes over the pulley W at the end of the gib, and has the tongs VT suspended to it. These are adapted to take up the pot between the hooks or claws T, at the lower ends. The two limbs are united by a joint like shears, and the upper ends V, are connected with the great chain by a few links. The pot has a projecting rim round the edge, and the tongs take this rim to lift the pot out of the furnace. The pot being wound up to the required height, by turning the handle *a*, the gib of the crane is swung round, to bring the pot over the pouring machine, and it is lowered down into it, for the convenience of swinging the crane round a worm, which is fixed upon the column X at O and a worm or endless screw is mounted in the frame *z*, to work in the teeth of the wheel. The screw, being turned by a winch on the end of its spindle, will cause the gib to move round on the column.

(To be continued.)

ON WEIGHTS AND MEASURES.

SIR,—With much pleasure did I learn, during the last Session, that a Bill for Equalizing the Weights and Measures was before the House; and though a variety of circumstances prevented me from giving it due attention at the time, yet I embraced the earliest opportunity of making myself acquainted with the provisions of the enactment. Emanating, as it did, from the venerable Vice-President of the Royal Society, I entertained the most sanguine hopes of our being at last put into possession of a simple and philosophical system of weights and measures, and you will judge of my disappointment upon finding that its provisions were merely to enforce the Acts of 1758 and 1760, and to state the ratio between the "imperial standards" of those Acts and certain "invariable natural standards," which it points out; at the same time that local variations are still to be allowed, as heretofore, on the condition of the ratio of such local weights and measures to these "original and general standard" weights and measures.

However, though the Bill did not meet my expectations, it is certainly well calculated to answer the intentions of its author; still, I think, it would have been better to provide for a total abolition of all local variations from the general standard—if not *immediately* convenient, yet at some future stated period, as, for instance, three years. This proviso would, no doubt, have abolished the practice in much less time; or, taking the lowest view of its efficiency, it would have prepared the public for the change, so as not to throw any difficulties in the way of its operation at the expiration of the intervening term. One advantage, however, arising from the Bill in its present form is, that it gives a something greater power for detecting fraudulent dealers, and is therefore of importance to the consumers of every kind of article in an economical point of view.

Allow me, then, through the medium of your *truly useful* publication, to call the attention of your readers to the principles of a system of weights and measures which unites perfect simplicity with universality of application, and which, so far from being a subject of mere untried speculation, has been in *national operation* for more than the third of a century—I mean the French system of weights and measures. Though the excellence of this system has been duly appreciated by scientific men in this country, I am not aware that it has been presented to the mass of our countrymen in any form whatever. The greatest obstacle that was found to its introduction into France, was found to arise from its not having been made a portion of the general system of elementary instruction; and, perhaps, we shall not be too sanguine in our hopes, when we assert our belief that, in four or five years, the British Public may be brought into a state to adopt this system without any of the inconveniences which were felt by our continental neighbours. Indeed, I conceive that more rests with *you* in forwarding this truly laudable purpose than with any other individual in the British empire; and I feel confident, that, on so important a subject, your assistance and co-operation will not be called for in vain. *You* have the means of explaining, illustrating, and enforcing upon the minds of the operative classes, the *great general utility* and *individual advantage* that must result from its adoption. By your influence it would find its way into those schools where our artisans receive their iota of education, especially when the parents of the pupils see its advantages and call for its adoption; and surely those parents cannot need much inducement to do so, when they find that a boy is obliged to study arithmetic for *about three years* before he enters upon algebra in this country, whereas, in France, *three or four weeks* usually suffice! How much geometry, perspective, drawing, and natural philosophy, might a boy acquire in the time that is thus wasted in our English seminaries, and all through the intricate and absurd systems of weights and measures that prevail amongst us! How much better would the education of our artisans

be, if such a facile and philosophical system were adopted! Does not every well-wisher to his country feel interested in the change? And can any man who has the slightest influence remain neutral on so important an occasion?

I propose to have the new system of weights and measures *added to the usual subjects of a common education*, rather than *substituted for* them; and it is obvious that, under existing circumstances, little more than this can be hoped for, at least till a legislative enactment has abolished the old and intricate system at present in use amongst us.

Let us gradually familiarize our artisans to the change—let your correspondents occasionally use the new system in their communications—let the more intelligent workman explain it to his shopmates, and these to their families—let all calculations given in one measure be converted by your readers into the other, and then back to its original state, as so many arithmetical exercises—then will a gradual familiarity with the new, and a distinct perception of the relations of both, be formed throughout society, and loudly call for a legal introduction of that system, the advantages of which will then be so generally felt. Then, indeed, shall we be able to confer upon future generations the most valuable improvement in general education that has ever been attempted—a system that will influence the destinies of our country, by its effects upon the mechanic arts, to an extent that few can at present anticipate!

I shall now, with your permission, give your readers a summary of the principles of the system, and hope to meet with that co-operation from your correspondents that will ultimately render the subject perfectly familiar to the lowest capacity, even though shackled with the complex machinery of English arithmetic.

Principles.

The computed length of the meridian of the earth was divided first into four parts, and each of these into ten million parts. This quantity was taken as the base of the whole system, and was denominated a

Metre.

Now it is obviously unimportant what we take as the base of our system, provided we can always refer to some invariable test by which to determine the accuracy of our unit of measurement. In this view, perhaps, the length of a pendulum, vibrating seconds mean time in a given latitude, and under a given temperature, may be more convenient and more *certain*, though not more permanent than the length of the terrestrial meridian. It will generally, no doubt, be preferred by every country to select for its unit the length of the seconds' pendulum in the latitude of its own capital; but it would be more generally convenient to assume the same unit throughout the world; and that none of these little traits of national jealousy might prevent so desirable an event, it would be well to let the equator be selected for the experiment. To return from this digression, we remark, that all the divisions and multiples proceed by *tens*, or, in fact, that all the operations are reduced to the very simple ones resulting from a decimal scale The *metre* being unity of length, we have the following table:

Ten-millimetre, or ten-thousandth of a metre,	$= \frac{1}{10000}$	$= \cdot0001$
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Superficial measure is generally reckoned in square metres, &c. but the unit of *land* measure is the square containing a hundred square metres, which is called the *are*. The unit of measure for fluids is called the *litre*,

and is equal to the cube of the *decimetre*.

The unit of measure for solids is a *centimetre cube*, and is called a *gramme*

The *metre cube* is used for timber measure.

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I remain, Sir,
Your most obedient servant,
Bath, Oct. 1824. T. S. D.

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SIR,—in reply to Piger's application, for a *rational faith in signs*, permit a reader of your paper to remind him, that, as when $-b$ is to be multiplied by $+a$, $-b$ is to be repeated a times; and any number of negative quantities gives a negative sum: so, when $-b$ is to be multiplied by $-a$, $-b$ is to be subtracted or minused a times; and, as the subtracting of any number of negative quantities is the same as adding the same quantities taken positively, and the addition of positive quantities gives a positive sum, the product will be a times $+b$ or $+ab$.

In the example Piger has given, his multiplier is plainly a positive term; for -3 times is 3 times less than never, (i.e.) his friend would be three removes from the failure mentioned, or + 90*l*.

If Piger wishes for a *rational* introduction to the science, he will find "Bridge's Lectures," or "Bridge's Elements," to contain what he desires; at least the latter has been quite satisfactory, hitherto, to

TYRO + PIGER − 3.

CHRONOMETERS

The indispensable use of the Chronometer in determining longitudes at sea is well known. It has, therefore, become an object with the Government of this country, and of every other maritime state, to render this instrument as perfect as possible. The variation of a few seconds from mean time might occasion in the navigator a mistake of some miles, and consequently, on a dangerous coast, or in a dark night, render the loss of life and property inevitable. The Lords of the Admiralty, alive to the importance of the subject, offered last year a premium of 300*l*. for the best chronometer; and the eagerness of the competition excited exceeded greatly the value of the reward. No less than thirty-six instruments, made by the most eminent watch-makers in London, were sent to the Royal Observatory at Greenwich. Their respective rates of going were observed with the most rigorous astronomical accuracy, and carefully noted in the books of the Observatory. The approximation of some of them to perfect accuracy will easily be admitted, when we mention that the one which obtained the prize (Mr. Murray's, of Cornhill, No. 816), did not vary in its mean daily rate more than one second eleven hundred parts of a second for one year. This instrument was purchased by the Lords of the Admiralty, and is now with Captain Parry on the Polar expedition.

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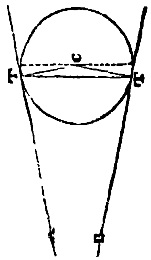
for if A and B were the sides of a guage, T T would be the tangible points of the wire, instead of at the true diameter, C.



This may not affect the beneficial use of the instrument, provided it be marked with strict mathematical allowance for the error; so that each mark should stand at the *true diameter* of the wire, instead of at the points where it must touch the guage, or all wire rated by the one offered would be of greater diameter than that instrument would give it.

C. HAYTER

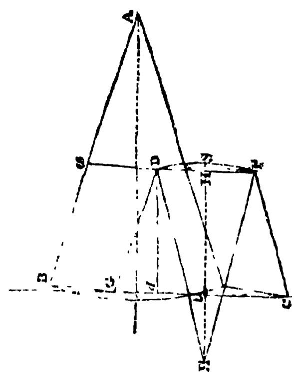
16, Buckingham-street, Portland-road, Sept. 13, 1824.

CALCULATING THE RADIUS ROD OF STEAM ENGINES.

[We have already inserted (p. 329, vol. II.) one answer to the Query of Gulielmus on this subject (page 230, vol. I.), and give insertion to the following, as, in our opinion, a still more satisfactory demonstration of the rules to be observed.—ED.]

SIR,—I believe the calculation for what is called the Radius Rod of Parallel Motions for Steam Engines, is known but to very few engineers or engine-makers, on this account—the general practice now is, to make the radius rod and parallel rod both of the same length, and this length equal to half the radius or one-fourth the whole length of the beam. The rods so constructed confine the piston rod to move up and down in a perpendicular line; but whenever the above rule is deviated from, and the parallel rods made shorter than one fourth the length of the beam, which is often necessary to be done, it then requires a very nice and accurate calculation by figures to accomplish the object. Therefore, for the information of your correspondent Gulielmus, and others of your numerous readers, I send you this drawing and calculation, with dimensions in inches, which I hope will be understood, and give satisfaction to all such as stand in need of it.

I am, Sir,
Respectfully yours,
I. R. (a Man in the Moors.)



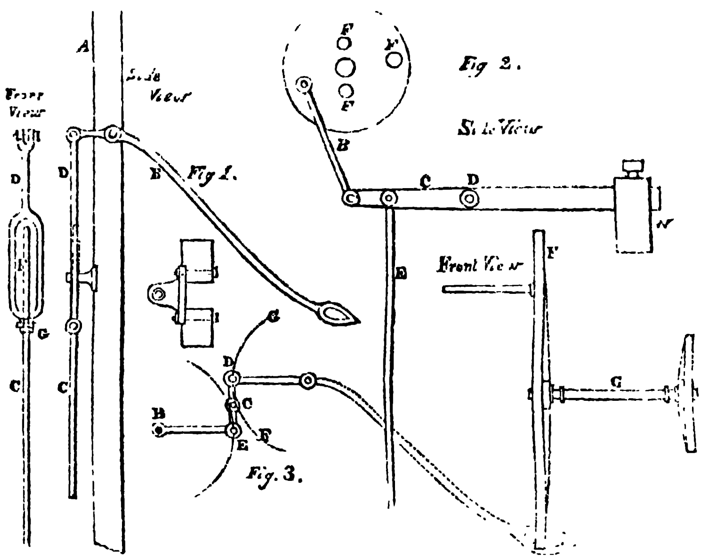
A B, radius of the beam = 49.5 inches, G D, parallel rod = 22 inches, and G C, length of stroke = 30 inches, given to find E D or E F = radius rod. First, 49.5 − 22 = 27.5 = A *a*, then as 49.5 : 30 :: 27.5 : 16.666, or D F = chord to segment described by radius rod; then G C, or $\frac{30}{2}$ − D F, or $\frac{16.666}{2} = 6.667 =$ *d* G. We now have got a triangle, D G *d*, with perpendicular and hypothenuse given to find the base, the difference between which and hypothenuse will = H S, or versed sine to the chord D F. Then, by Euclid, book 1st, prob. 47th, $\sqrt{\overline{DG}^2 - \overline{Gd}^2} = 20.965$ = D *d* = base, and G D − D *d* = 1,035 = H S = versed sine.

Then $\frac{HD^2 + HS^2}{HS} = \frac{68.125}{2} = 34,0625$ = E F, E D, or radius rod, which, if constructed by the above calculation,

will confine the point G to traverse the perpendicular line G C.

N.B. The two lines *a* D and B G represent two links on each side of the beam, to which the parallel rods are suspended, and allow the top of the piston rod, G, to be wholly guided by the radius rod E D, E F.

PUMP IRONS.



SIR,—I send you three plans of Pump Irons, copied from drawings which I have worked by. I have found them to answer very well, when properly made and fixed, and should be highly gratified should you think them worth a place in your Magazine.

In answer to J. Bennet, of Lincoln, I advise him to visit the Fen Engines, near Boston, when I feel no doubt he will be satisfied of the truth of what I asserted in a former letter. Or should he come to London, I can show him two pumps I fixed myself, precisely the same as those described by him.—I am, Sir, &c.

X. Y. A MILLWRIGHT.

Blackfriars-road, Aug. 6.

Description.

Fig 1 is the plan I generally adopt for a common lifting pump. A is the pump standard, with the handle B connected to it; C the pump rod; D a sling, with a double joint at each end: the upper part of the pump rod C passes through a guide above the joint G, which always keeps the pump rod upright; the joints should be bushed with steel, and steel pins turned and fitted nicely, and they will last for many years without shaking in the least. But when I am confined for room, as is frequently the case, I use Fig. 3, where A* is the joint of the pump lever or handle; B a radius rod of the same length from B to E, as the pump lever from A to D; the ends D and E are connected by a link with three holes in it; the pump rod is slung to the middle hole, and by the radius rod and pump lever being fixed in the same vertical plane, the hole C will describe a straight line, or very nearly so, provided the arc F G does not much exceed 40 degrees.

Fig. 2 is for deep wells, where the pump is obliged to be fixed in the well. The pump rod E is attached to a beam or lever C, which swings on a centre D; the connecting rod B is also joined to the beam C at the extremity, the other end being fixed to the crank pin in the flange

* This letter has been omitted by our draughtsman; but the joint which it was intended to indicate is sufficiently obvious.—EDIT.

A, which has holes, marked F F F, at different distances from the centre, in order that the quantity of water to be raised may be regulated by giving the pump rod E a longer or shorter stroke. The flange A is firmly fixed on a shaft, with a fly wheel at the other end, and a handle fixed to turn with the weight marked W, at the outer end of the beam; C has a set screw at the top side, to allow it to be moved farther off or nearer to the centre, as may be required. It should be placed so as to balance the weight of the pump rod, and half the column of water to be lifted.

P.S. I fixed one on this principle, by which, with the assistance of a wheel and pinion, one man raised seven gallons of water per minute, from the depth of 120 feet, with the greatest ease.

HINTS TO COAL PURCHASERS.

The great source of the frauds which so notoriously prevail in the trade in Coals, is the difference which exists, in point of quantity by measure, between coals as they came out of the mine in large round masses, and the same coals when broken down, and, as is too generally the case, wetted, for the express purpose of increasing their bulk. For instance, if a vat of Wallsend coals be measured from the ship, according to such measure as the meter is in use to give, and the coals be then turned out and broken to the size at which merchants commonly send them out to their customers, it will be found, on filling the vat again, that there is a surplus of a full bushel and more. So alive are the dealers to the advantage to be derived from this circumstance, that when a score of Wallsend coals is measured out in the Pool into a barge having four rooms, each containing five chaldrons and a half, as in grain, no sooner does the barge arrive at the wharf, than the coals are taken out, broken, and well served with water; nor is the coal-merchant satisfied, unless he can by this practice multiply his five chaldrons and a half into six and a quarter, or even six and a half. Some merchants there are, who, from the keenness of competition, will promise to give sixty-eight sacks to a room: and well they may, for the fact is, that every room of good coals, such as the Wallsend, Percy Main, Cowper, &c. which are all put on board of ship in large blocks, will, when broken down, measure out at least seventy-five sacks! The general rule, however, when a room of coals is bespoke, is to send in only sixty-three sacks with the meter's ticket; the overplus, of twelve or more sacks, the merchant honestly keeps to himself.

The frauds in a large way, however, are nothing to what they are in the smaller traffic carried on by the owners of those coal-sheds which abound everywhere in the metropolis, and to which the poor, the least able to suffer from imposition, are obliged to resort for their supplies of this indispensable article. It is a known fact, that when one of these petty dealers orders in a room of coals, he lays his account with turning every chaldron of thirty-six bushels, which he receives, into forty-two bushels to his customers. It is not by the aid of the hammer and pitcher alone that this wonderful trick of multiplication is effected; but, in consequence of the Act of Parliament regarding the measure of coals being silent as to the smaller measures of a peck, half-peck, &c. which leaves these low dealers at liberty to make, as they do make, a very liberal use of the additional opportunity which this circumstance affords them, of imposing on the poor buyer in the quantity of his hard-earned purchase.

The obvious remedy for all these impositions, whether on a large or small scale, would be to abandon altogether the present erroneous mode of measuring coals, and to have them sold *by weight*, which would put it out of the power of the seller to defraud even in the smallest quantity. It is surprising, indeed, that the necessity for such a change of regulation has not ere now attracted the serious attention of the legislature.

Were the plan of weighing adopted, each sack of coals should weigh, after deducting the weight of the sack, two hundred and fifty-five pounds.*

As coals are sold at present, the only rule which can be laid down for

* Edington's Treatise on the Coal Trade.

the purchaser's protection, applies to the case of buying a whole room of coals at a time. When this is the case, he may stipulate that the room shall be transferred to him as measured out into the barge from the vessel; but this is a condition which he will probably find few sellers disposed to assent to.

It may at first sight occur, that were coals to be sold by weight, the opportunity of committing fraud, by watering them, would be increased. But this is not the case; for if a bushel of Wallsend coals be measured when dry, it will weigh from 84lbs. to 85lbs.; whereas another bushel of the same coals, well wetted, will be found to weigh considerably less. This difference is easily explained on mechanical principles. A bushel of dry coals, let them be ever so round, has always a part small, which runs like dry sand, and fills up every cavity, making the whole nearly a solid mass; but when the coals are wet, they clog together into masses, and leave the cavities unoccupied. R.

SOLUTION OF THE GEOMETRICAL EXERCISE, Page 8, Vol. II.

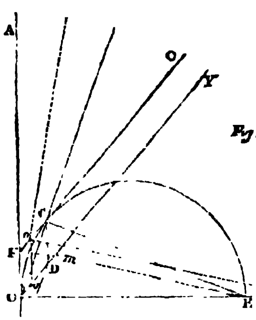


Fig. 1.

Make O F = O B; through F draw F G parallel to O Y. It is evident that F G is the *locus* of all the points C which determine the value of O E; and that, when O C bisects the given angle A O Y, F G is a tangent at C to the semicircle described upon O E. Consequently, wherever O C is drawn within the angle A O Y, except in the bisecting direction, it must cut the semicircle, O C E, before meeting F G. Let O c, therefore (drawn, as in the figure, any where within the angle A O Y), cut the semicircle in the point m: join m E: then O m E being a right angle, m E is parallel to c e. Therefore O m : O c = O E : O e. But O m is less than O c; therefore OE is less than O e. Q. E. D.

ANALYTICAL DEMONSTRATION.

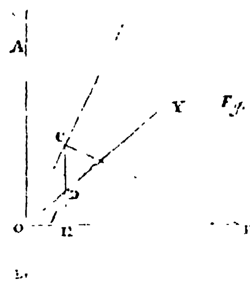


Fig. 2.

Calling the angle, AOC, x, and the angle, COY, y; also the given distance, OB or CD, a. Then CD being perpendicular to O E, the angle E = (O C D) − x, and O D C is the supplement of ($x+y$). Therefore, to radius O E, O C in the triangle O C E is sin. x, and in the triangle O C D is the sine of the supplement of ($x+y$), or simply sin. ($x+y$), C D or a being sin. y. Now O E = $\frac{OC}{\sin. x}$ to rad. 1, and O C = $\frac{a . \sin. (x+y)}{\sin. y}$

$$\therefore \; OE = \frac{a . \sin. (x+y)}{\sin. x . \sin. y} = a . \frac{\sin. x . \cos. y + \cos. x . \sin. y}{\sin. x . \sin. y} = (\cot. y + \cot. x)\, a.$$

Consequently O E is a minimum when ($\cot. x + \cot. y$) is a minimum; that is, when $-\frac{\delta x}{\sin.^2 x} - \frac{\delta y}{\sin.^2 y} = 0$, or when $\frac{\delta x}{\sin.^2 x} = \frac{-\delta y}{\sin.^2 y}$. But since ($x+y$) is constant, $\delta x = -\delta y$; therefore O E is a minimum when $\frac{1}{\sin.^2 x} = \frac{1}{\sin.^2 y}$, or when $\sin. x = \sin. y$; that is, when O C bisects A O Y. Q. E. D.

NATHAN SHORT.

LONDON YEAST.

The Yeast which is employed in London is obtained from the brewers, and hence is often tainted with the hop mixture. In other parts, such,

for example, as Edinburgh, the bakers make use of an artificial yeast, prepared in the following manner, which is quite free from any such taint, and answers the purpose of fermentation equally well. To 10lbs. of flour they add two gallons of boiling water; they stir it well into a paste; they let this mixture stand for seven hours, and then add about a quart of yeast. In about six or eight hours this mixture, if kept in a warm place, ferments, and produces as much yeast as will bake an hundred and twenty quartern loaves.

Some years ago, the bakers of London, sensible of the superiority of this artificial yeast, invited a company of manufacturers, from Glasgow, to establish a manufactory of it in London, and promised to use no other. About 5000l. was accordingly laid out on buildings and materials, and the manufactory was begun on a considerable scale. The brewers finding their yeast, for which they had drawn a good price, lie heavy on their hands, invited all the journeymen bakers so their cellars, gave them their full of ale, and promised to regale them in that manner every day, provided they would force their masters to take all their yeast from the brewers. The journeymen accordingly declared in a body, that they would work no more for their masters, unless they gave up taking any more yeast from the new manufactory. The masters were obliged to comply; the new manufactory was stopped; and the inhabitants of London were thus obliged to continue to eat worse bread than their neighbours, because it is the interest of the brewers to sell their yeast.

B. G.

BEAUTIFYING AGATES.

Dealers in Gems have a secret method of producing, artificially, some beautiful effects in Agates, which, to the eye, have all the appearance of being natural, and being insisted on as such, serve at times to cheat the amateur out of very high prices. These effects are supposed to be obtained by a succession of blows adroitly struck, on the stone, previous to its being polished. The means of detecting the artifice, taking it for granted that such is the mode of operation, are sufficiently simple. Every blow must have produced, under the place where it was given, the figure of a regular cone, with its base next to the point of contact. Traces of this figure may sometimes be discerned by the naked eye in the polished stone, and always with the aid of a microscope. To make quite sure of their having been artificially produced, wet the stone, when the traces will be found almost entirely to disappear, on account of the liquid penetrating the fissures, and afterwards to reappear on the stone becoming dry.

HOW TO IDENTIFY SILVER.

Silver, in its native or virgin state, has a great external resemblance to tin, but may, on examination, be easily distinguished from that metal by its being much heavier, and by its remaining unaltered under the operation of fire, whereas tin burns entirely away under a continued heat.

As ores of silver are frequently combined with other metals, it may be of use to furnish the inquirer with a test, by which he may ascertain both its presence and the quantity in which it is combined. For this purpose, let him put a few particles of the ore into a watch-glass; add two or three drops of nitrous acid; then hold the glass over the flame of a candle till the ore is dissolved; after which dilute the solution with water, and stir it about with a bright copper wire. Whatever silver is present will immediately separate from the solution, and attach itself to the wire. Or, instead of making use of the wire, add to the solution one drop of muriatic acid, or common salt, and the silver, if any be present, will be separated in a dense and dull white cloud.

HAWKINS' STEAM ENGINE.

We took notice, in our 47th Number (p. 301, vol. II.), of a new Steam Engine, of great promise, invented

by a blind man in America, of the name of Hawkins. We find it since advertised in the American Papers in the following terms; the description is, however, still incomplete. Our next budget from New York may probably supply what is wanting.

"Messrs. Hawkins and Planton's new principle of creating steam by generators, and by the exposure of a small quantity of water to the action of the fire, supplied from the condensed steam at each stroke of the piston by a forcing pump, has been judged by scientific and practical men as possessing all advantages which can be reasonably wished. Safety, since the generator or generators contain but a sufficient quantity of steam to work the machinery; lightness, since they carry no water; compactness, since the generators will never occupy more than the twelfth part taken by the boilers; and a great economy of fuel, since the generators, being surrounded by the fire, receive all the benefit of its action; besides that, they will raise steam in fifteen or twenty minutes, which, on the old plan, takes an hour and a half. This invention has the unquestionable advantage of being applicable to all old engines of high or low pressure, by removing only the boilers."

CONTRACTION BY COLD.

Some years ago it was observed, at the *Conservatoire des Arts et Metiers*, at Paris, that the two side walls of a gallery were receding from each other, being pressed outwards by the weight of the roof and floors. Several holes were made in each wall, opposite to one other, and at equal distances, through which strong iron bars were introduced, so as to traverse the chamber. Their ends outside of the wall were furnished with thick iron discs, firmly screwed on. These were sufficient to retain the walls in their actual position, but to bring them nearer together would have surpassed every effort of human strength. All the alternate bars of the series were now heated at once by lamps, in consequence of which they were elongated. The exterior discs being thus freed from the contact of the walls, they could be advanced further on the screwed ends of the bars. On the bars projecting on the outside of the walls from the elongation, the discs were screwed up; on removing the lamps, the bars cooled, contracted, and drew in the walls. The other bars became, in consequence, loose, and were then also screwed up. The first series of bars being again heated, the process was repeated; and by several repetitions, the walls were restored to their original position. The gallery still exists with its bars, to attest the ingenuity of its preserver, M. Molard.—*The Chemist.*

EXPANSION OF WATER IN THE ACT OF FREEZING.

SIR,—In the Mechanics' Magazine, No. 60, there is an article on the Contraction and Expansion of Water, copied from *The Chemist.*

It is there stated that water introduced into a tube, and plunged into a freezing mixture, *contracts* till it be reduced to the temperature of 42°, after which it gradually *expands* till it becomes ice. This the writer is pleased to call a *miracle*, and at variance with the general law, that bodies expand by heat and contract by cold. Be it a miracle or not, the fact is but too familiar with us every severe winter, by the bursting of our water pipes. But let us examine what takes place in the conversion of water into ice, and then see whether its floating upon water be sufficient to constitute a miracle.

Water, in the act of freezing, parts with the heat which kept it in a state of fluidity, and in this act there is an internal violence, a different arrangement of parts, or, in other words, a crystallization, in which small particles of air are interspersed, as may be seen by examining a piece of ice. That the admission of air is necessary for the formation of ice, appears by the fact, that water freezes very slowly in closed vessels. By this interspersion of globules of air in ice, it consequently occupies a larger space than it did in the form of water, and is, therefore, so much specifically lighter as to float upon it. Here, then, ends the miracle of *The Chemist*, for it is not the water itself which has expanded or acquired a greater volume, but it is the admix-

ture of air into the mass of congelation.

A slight degree of agitation of water in a shallow vessel, just at the point of freezing, much accelerates the congelation, and the crystallization of certain saline solutions is expedited by the same means, showing, by analogy, that ice is a true crystallization.

I am, Sir, &c.

GELIDUS.

A SECRET IN BUYING.

Buy in winter, and sell in summer, whatever is bought and sold by measure. Thirty-two gallons of spirits bought in winter will, without being in the least diluted, make thirty-three in summer. The reason is, that all bodies, fluids especially, expand with heat and contract with cold.

NEW STEAM ENGINE.

SIR,—Having, some time since, announced my intention to undertake a set of experiments on Steam, and promised a publication of the results, it may be proper to state, that a variety of unforeseen and unavoidable circumstances, in conjunction with daily avocations of a different sort, have procrastinated the completion of the object much longer than I anticipated. The time, however, I am happy to say, is now not far distant, when I hope to redeem the pledge, and to divest the subject of many absurd notions with which it has hitherto been associated.

It is not my intention now to enter upon the information and facts I have acquired, as they, together with what has been done by others, will, with more propriety, be fully detailed at a future period, more especially as you are acquainted with my opinion of the inefficiency of what has as yet been accomplished, and my ideas of the plan that should have been adopted to effect the object desired. The results, however, of my investigations, though not yet concluded, have given rise to a perfectly novel combination of machinery, as a medium for applying the power of steam, widely differing from any thing that has hitherto been attempted; whereby, as appears from the calculation with which I have furnished you, the effect will be eight times greater from the same quantity of steam, and about fifty times more power will be produced from the same quantity of fuel, than what is obtained from an engine on the plan of Watt. The simplicity of the combination, and the action of the steam, are such, that no very great diminution of effect can possibly take place in practice; but we will assume that the saving will be 19-20ths; even then the advantage will be immense. The space, too, which would be occupied by an engine of forty horse power, will scarcely exceed that of the present cylinder.

Your readers may possibly consider my assertions chimerical, but you, who are more in possession of the subject, will be enabled to form an opinion; and as soon as arrangements are made, and the improvements properly secured, means will be taken to apply it publicly to some practical purpose, whereby its power will be defined, and placed beyond all doubt.

I am, Sir, &c.

19th Oct. 1824. W. GILMAN.

P.S. Nothing, perhaps, illustrates more clearly the necessity of the object my humble efforts have been endeavouring to accomplish, than the following quotations, which are decisive evidence as to the little that has been done, by way of experiment, relative to the most economical method of producing steam:—"As to boilers, there is a prodigious difference both in practice and opinion; according to some, eight cubic feet of contents—to others, twenty, are necessary for each horse power. In the Meteor, Sovereign, and Engineer (which have small boilers), it requires about one ton of coals in 24 hours for each nine horse power. In other vessels it is double the quantity, or one ton for a four and a half horse power."

Reference having been made by our Correspondent to the private knowledge we possess of the improvements he

has in progress, we have no hesitation in saying, that we entertain but little doubt they will realize the full measure of advantage which he has here promised.—Ed.]

ACHIEVEMENTS OF SCIENCE.

It is well known to philosophers, that there was a time when the laws of the moon's motions were so inexplicable as to defy all human attempts to reduce them to any simple principles, capable of being applied for predicting her future situation for any given time with exactness; and the same could then be said of the tides, the orbits of comets, and various other particular parts of astronomy and natural philosophy: but by the unwearied diligence and researches of a few profound mathematicians, this uncertainty respecting them now no longer exists. There are, indeed, few things of this kind that cannot by degrees be brought to some system. Empiric modes are first applied of explaining and computing the several motions; then by investigating, comparing, and gradually approximating to the observations, we come at length to causes which rest on established principles, and ultimately every apparent anomaly is accounted for by a reasonable and satisfactory theory.

EXTINGUISHING FLAME.

Sir,—It may serve to illustrate the observations of Captain Manby, in your 59th Number, on the best means of Extinguishing Flame, if you will give a place in your pages to the following results, which I abstracted, some time ago, from one of Sir Humphry Davy's papers in the Philosophical Transactions :—

"Different elastic fluids have different effects in extinguishing flame; nitrous oxide is the lowest, olefiant gas the highest as to this power; and this does not depend upon capacity for heat or density, but on an actual power of abstracting heat, which is much highest in the combustible gases, and which seems analagous to *conducting power* in solids and fluids. Steam has very low powers of preventing explosion, and azote has low powers compared to inflammable gases. The increased cooling power of the azote in condensed mixtures prevents the combustion from increasing very rapidly, and the diminished cooling power in rarefied atmospheres interferes with a rapid diminution of the heat of combustion; so that at all pressures which can occur at the surface of the earth, the atmosphere still retains the same relations to combustion."

Ba th , O 2, 1824.

DOUBTS *versus* DIFFICULTIES.

Sir,—In the case of "Doubts *v.* Difficulties," it does not appear that the plaintiff has clearly established his point. To use the quaint expression of *Lawyer Scout*, he ought to have established it "in *law* and in *fact*." I feel pretty certain that your Correspondent "A." has neither wielded a *screw-driver*, nor shaken his *two paws* over a Turkey stone, so long as I have done, otherwise he would have been of a very different opinion. He says the abrasion *must evidently* be produced from a mechanical, and not by a chemical action. I would ask him, *How does he know that!* I never found it difficult to keep the water upon the surface of a Turkey stone; and although water may have been frequently used to the axles of wheels, yet it is only vulgar philosophy that instructs us to believe that it acts as an unguent. As to the *perpendicularity* of the long screw-driver, this is too childish to need a refutation, as *every mechanic* who is in the habit of using a tool of that description must be aware of the erroneousness of "A.'s" explanation. For the present, however, I pronounce that the extra power arises from the greater elasticity of the long screw-driver, and I would wish that your Correspondent would enter more keenly into the discussion, before you think, good Mr. Editor, of dismissing the subject *simpliciter*. The case, to my view, remains in *statu quo*—let him send it to *a tzandum*, and pray let us have another *hearing*.

I am, Sir,
Your obedient servant,
Nichol Dixon.
Red Lion-street, Clerkenwell.

PLATINUM.

When Platinum is pure, it is of a silvery white, inclining to iron grey; it resists an intense heat without alteration, but may be easily fused in the focus of a burning lens. It is tarnished with much difficulty, and hence the use which is made of it for the touch-holes of fowling pieces, &c. Its identity may be ascertained by the following test. Dissolve it in oxymuriatic acid, or a solution of chlorine or nitro-muriatic acid (the only substances by which it is soluble), then add a little muriate of tin to the solution, when the platinum will be precipitated of a reddish colour.

GOOD SALT.

A difference, in point of quality, greater than is generally imagined, exists between salt recently manufactured, and salt which has undergone depuration, and been well drained from the brine and bittern. Recent salt is not well adapted for preserving meat, or the uses of the table; it imparts to meats a bad taste, vitiates their colour, and prevents them acquiring that firmness which is essential to their preservation. It is, moreover, subject to great waste during its conveyance to any distance, as it dissolves in a moist air, and runs into a liquid state. Salt which is of a good age may be distinguished from recent salt, by a taste penetrating, yet free from bitterness; by the solidity of its fabric, and by its not deliquescing when exposed to a moist atmosphere.

TRUE AND FALSE VIOLETS.

The violet colours imparted to silk are of two kinds, *true* and *false*. The true are produced from cochineal and savory; the false from savory alone. In order to distinguish between them, drop a little of any acid on a piece of the cloth, or expose a piece of the cloth to the fumes of any acid; if the violet becomes changed into red, it is a proof that the dye was of that description called *false*.

OPEN DAYLIGHT.

ANSWER TO INQUIRY.

NO. 60.—EXTRACTING FAT BY STEAM.

SIR,—In Number 55, Inquiry 66, of your Magazine, T. J. requests to be informed of a method to extract Fat by Steam, or in a way that it will not come in contact with the fire heat. I would recommend him to use a double furnace (of copper), and that the cavity between the two divisions should be kept filled with water, and made steam tight, with a self-supplying water-cock, and a safety-valve. With a furnace of this description, any degree of heat may be applied to the smallest quantity of greaves or dregs, and the fat rendered would be found to be of a superior whiteness, which I believe also to be a desirable object.

I am, Sir, &c. J. P**.

Paternoster-row.

ERRATUM—Inadvertently your Printer has used (in last Number, page 69) the sign of a fluent ($\int$) instead of that of a root ($\surd$), to the formula for the "Centre of Gyration," which has made it totally wrong; it should be

$$\sqrt{\frac{R^4 - r^4}{2R^2 - 2r^2}}.$$

B. B.

CORRESPONDENCE.

Sir,—Being particularly desirous of obtaining a sight of Mr. Ellington's Patent Lock, a description of which is given in No 57 of the Mechanics' Magazine, I was much pleased to see, in the last Number, Mr. Ellington had informed you, in answer to the inquiry of G. M. B, that his lock was to be had at the Balloon Ironmongery Warehouse, Bishopsgate. I was much disappointed, on calling there, to be informed that they had no lock of that description, neither did they know any such person as Mr. Ellington. You will much oblige me by noticing this in your Magazine, as it may lead to an explanation, and I may yet get a sight of this lock.

I am, Sir,
A CABINET-MAKER.

Oct. 25th, 1824.

** We have to request indulgence from our other Correspondents till next week.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.
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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

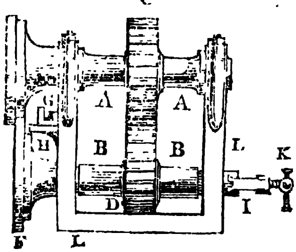
"The most valuable gift which the Hand of Science has ever yet offered to the Artisan." Dr Birkbeck.

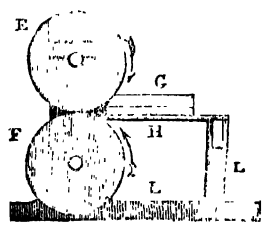
No. 63.] SATURDAY, NOVEMBER 6, 1824. [Price 3d.

"Learn some useful art, so that you may be independent of the caprice of Fortune."—*Cato*

PROCESS OF COINING AT THE ROYAL MINT.

(Continued from our last Number.)





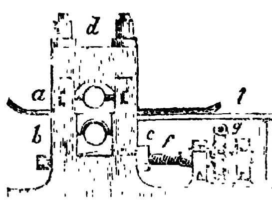


Fig. 2 of the Engraving prefixed to our last Number represents that part of the pouring machine in which the pot is placed: *m* is an axis, which is mounted in the frame of fig. 1 by the pivots at its ends. To this axis is fixed a cradle, which receives the pot. The cradle is joined together so as to open and shut, and the screw *m* draws the parts together until they will fit. The pot L is an arched rack, forming a continuation of the principal bars of the cradle. When the cradle is in its place, as in fig 1, the rack L is engaged by a pinion K, and can thereby be elevated so as to pour out the metal at a lip or spout, which is made at the edge of the pot for the purpose. The axis of the pinion K is turned by means of the winch D, with a train of wheels, DE, FG, and KI The man who turns this winch stands before the pot, so as to see what he is doing. The frame of the pouring machine is sufficiently evident from the figure. It is so made as to leave an open space beneath for the carriage containing the ingot moulds.

Fig. 4 is a separate view of a pair of ingot moulds. The two parts, R and S, put together, and form a complete mould, as shown in fig 5. The upper edge of the mouth is a little enlarged, to facilitate the pouring of the metal. The moulds are made of cast iron The part R has the bottom and one side formed on it, and the other half, S, has one side formed on it. Before the moulds are used, they are heated in an iron closet, which has flues surrounding it, and they are then rubbed on the inside with linseed oil.

P Q, fig. 1, is the carriage into which a row of these moulds is placed, as shown at 1, and they are screwed up close by two screws, *pp*, so as to hold them tight; the moulds rest upon a plate

which is suspended by screws q, at each end, and can by that means be raised or lowered to suit different heights of moulds. The carriage is supported on four wheels, QQ, which run upon a rail-way. P P is a rack fixed to the bottom plate of the carriage; in this rack a cog-wheel, N, acts; the cog-wheel is turned by a pinion, which has a handle, O, fixed upon it; by turning the handle the carriage is moved along the rail-way; and any one of the moulds, 4, can be brought under the spout of the pot, 2; then, by turning the handle D, the pot can be inclined so as to pour the metal into the mould until it is full.

In the silver melting-house there are eight melting furnaces, two cranes, and two pouring machines. Each crane stands in the centre of four furnaces, freely commanding the centre of each, and conveys the pots to the pouring machine. The eight furnaces are worked three times daily, and each pot contains, upon an average, 420lbs. Troy, making the total melting 10,080lbs. There are four men to each four furnaces; each party pour their own pots, and the whole meltings are finished, from the time of first charging in the morning, in little more than ten hours.

The whole of the silver meltings are conducted under the superintendence of the surveyor of the meltings; and he allows no silver to be delivered to the company of moneyers by the melter, unless he has a written order from the King's Assayer Master, authorising such delivery.

The meltings are performed by contract with the Master of the Mint and his first clerk, as melter. He is responsible to the Master for all the bullion he receives, and delivers weight for weight, which renders his situation one of considerable risk and great responsibility. He also finds security for the due performance of the duties of his office.

The bars of silver, of the approved standard, are delivered over to the moneyers, who perform the various processes of the coinage under contract with the Master of the Mint, always delivering weight for weight. They also give security for the due performance of the duties of their office.

Referring to the account of the operation of Rolling, given at p. 233, vol. I, we now proceed to describe the machine by which the plates of metal from the rolling mill are cut into slips of a convenient width for cutting out the circular pieces or blanks which are to form the coin. This width is generally that of two crowns, two half-crowns, and shillings.

The first and second of the figures given with this Number are representation of this machine. LL is a strong iron frame, which is screwed down to the ground sills of the mill, so that the cog-wheel D will be immediately over the shaft which turns the rolling-mill, and can be turned by a cog-wheel upon that shaft. The cog-wheel D is fixed upon an horizontal axis BB, which is supported in the frame LL. AA is a similar axis placed at the top of the frame, and turned round by a cog-wheel C, which engages with the wheel D. On the extreme end of each axis, A and B, a wheel or circular cutter, E and F, is fixed. The edges of these cutters lie in close contact laterally, and overlap each other a little. The edges of the cutters are made of steel hardened, and they are turned very truly circular, and the edges which overlap are made very true and square. Whilst they are turning round, if the edge of any piece of metal be presented to them, it will be cut or divided just in the same manner as a pair of shears. H is a narrow shelf, upon which the plate is supported when it is pushed forwards to be cut, and G is a guide fixed upon the shelf; the edge of the plate of metal is applied against this guide, whilst it is moved forward to the cutters. The guide is moveable, and the distance which it stands back from the cutting edges, or line of contact of the two cutters E F, determines the breadth of the slip of metal which will be cut off.

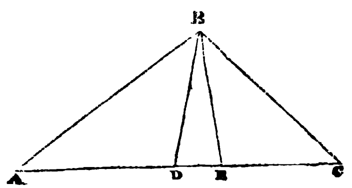
To give these slips of metal the exact thickness which is requisite before they are cut up into blocks, they are subjected to a more delicate rolling; or they are drawn between dies by a machine, invented by Mr. Barton, the present Comptroller of the Mint.

The third figure given in our present Number represents the finishing rollers, viewed at the end of the frame, in order to show the manner of adjusting them; for it is only in those parts that they differ from the great rollers: a is one of the pivots or centres of the upper roller; it is accurately fitted in a collar of brasses, which collar is held down in a cell at the top of the standard by a cap d, with two bolts and nuts. These are not intended for the adjustment of the rollers, as in the former instance; but the lower roller is moved for this purpose. The pivot b of the lower roller is received in a brass bearing, which is moveable in the opening in the standard-frame. The brass rests upon a wedge e, which is fitted in a cross mortice through the standard. By forcing the brass farther in the wedge of the lower roller, it will be moved nearer to the upper roller. The standard at the other end of the rollers is made in the same manner, and the wedges of both must be moved at the same time. To give them motion, a screw, f, is fitted into each wedge, and upon these screws are worm wheels, g, which are both

moved by worms cut upon an horizontal axis, that extends across from one end of the frame to the other, and has a handle at the end to turn it round by, and move the screws and wedges both in equal quantity; *l* is the table on which the metal is laid to present it to the rollers.

GEOMETRICAL EXERCISE.

The introduction of Geometrical Exercises into your excellent Journal will have a greater tendency to excite a thirst among my brother tradesmen for philosophical instruction, than any other scheme you could possibly devise, and particularly so if they are treated in a form suited to the capacity of those for whom they are intended. Although the generality of mechanics are displeased with the sight of a geometrical theorem (from experience I know this to be true), yet, if moderately persisted in, the plan will ultimately prove successful, for truth is mighty, and must prevail; and however rude and savage men may be, yet they are always open to reason and common sense, if left to think for themselves. Certainly no study can be better calculated than geometry for awakening the dormant qualities of the mind, and *forcing* them into action. I send you herewith another Exercise, which you may, perhaps, think worthy of a place in the "Mechanics' Magazine."



Let ABC be any angle; bisect it by the straight line BD, and from the vertex B let fall the perpendicular BE. It is required to prove, that $2\,DBE = ACB + BAC$—that is, twice the magnitude of the angle DBE is equal to the difference of the angles ACB, BAC.

Another grand object which will be attained by exercises of this nature is, that it will enable the mechanic to read philosophical books with greater ease and pleasure, by giving him a distinct notion of algebraic equations; and if you insert them, they will be read—if read, they will be understood—and if understood, I presume you have arrived at the *summum bonum* of your good wishes towards mechanics.

I am, Sir,
Your obedient servant,
JAMES YULE.

63½, Red Lion-street, Clerkenwell,
Sept. 25, 1824.

RUTHVEN'S ECCENTRIC WHEEL.

A new application of the principle of the Inclined Plane has been invented by a Mr. Ruthven, of Edinburgh, which promises, at first sight, to be of very extensive utility in the arts.

Let the reader conceive an iron pinion, driven by a winch, and revolving vertically, and a wheel of the same metal, in the same position, with its rim resting on the pinion, and revolving by means of the contact or friction of the surfaces. In this position they exactly resemble the wheel and pinion of a common crane, except that they have no teeth. Suppose the wheel to have its axis placed, not in the true centre, but a little on one side of it, so that the radii (or spokes) of the one side are an inch shorter than those of the other; it is plain, that if we begin where the shortest radii are in contact with the pinion, and make the wheel revolve half way round, the longest radii will then take the place of the shortest, and the axis of the wheel will be pushed or protruded one inch farther than it was from the axis of the pinion. It is this protrusion by the motion of an eccentric

wheel that constitutes the mechanical power of Mr. Ruthven's machine. The axis of the pinion turns in a fixed box or gudgeon, while the axis of the wheel is allowed to move up and down, within a longitudinal aperture; and by means of iron rods or pillars resting on the latter axis, the pressure is transferred to a platform in the upper part of the frame, and may be there applied to any purpose.

Mr. Ruthven varies the form of the wheel according to the object he has in view. In some cases it is elliptical, in some spiral, in others it has a heart shape, and in others he employs, not an entire wheel, but a sector embracing 50 or 60 degrees; and though the motion of the pinion is communicated to the wheel by the contact of their surfaces merely, yet where the eccentricity is great, he adds teeth for security.

The mechanician will easily discover, that the power in this machine is essentially that of the inclined plane. If, from the axis of the eccentric wheel, we describe a circle touching the circumference on the inside at the shortest radius, it is evident that the crescent which lies between this circle and the exterior circumference may be considered as a wedge, which, in the course of the revolution, is intruded between the two moving bodies, and forces the one to recede from the other. Now the superiority of this modification of the inclined plane over those in common use, seem to be chiefly these: —1. The principal portion of the friction is that of *rolling*, which, in the case of metal on metal, is probably not the twentieth part of the friction of *sliding*. The portion of the friction consisting of *sliding* is that of an axle within its gudgeon, which of all kinds of sliding friction is the smallest. 2. As compared with the screw and we may add, the hydraulic press, it has this grand advantage, that the power admits of every degree of gradation, while that of the former is perfectly uniform. Suppose, for instance, we work with a screw to compress cotton into small hard packages for exportation; then, since the resistance increases in a very high ratio as the compression proceeds, we may begin with one man, but we shall ultimately need to employ ten, because the power of the screw is no greater in the last stage than in the first; but, with Mr. Ruthven's machine, we accomplish that by the gradation of the power, which in the other case can only be effected by an increased application of human strength. By varying the curvature of the wheel, we can multiply the power so that the same application of human force, which produces a pressure of two tons in the first stage, shall produce one of a hundred tons in the last. 3. This accumulation of power, which is of inestimable importance in many cases, is sometimes effected by a combination of levers. But over such combinations, Mr. Ruthven's eccentric wheel has these advantages: first, that the mechanism employed is decidedly simpler, and the friction undoubtedly much less; secondly, that the elasticity, which often defeats the efficacy of combined levers, is completely obviated; thirdly, that we can vary the degree and measure of gradation in any way, with much greater facility; fourthly, the machine can be so formed that its motion shall be constant and progressive, without stops or backward movements, as is the case of levers. Indeed, the inventor thinks, that scarcely any task can be proposed to him which he is not able to perform. He is preparing an engine at this moment for punching, by mere pressure, holes of an inch square through bars of cold iron, five-eighths of an inch in thickness, by the strength of a single man.

With regard to the power of this machine, it is estimated thus:

Supposing a man, who pulls with a force of 30 pounds, to turn a winch of 15 inches radius, on the axis of which is a pinion of two inches in diameter, operating on a spiral wheel six feet round, and of half an inch of eccentricity (which gives an inch of protrusion); then the effect will be as follows:—$30 \times 15 \times 72 = 32{,}400$; that is, supposing the eccentricity to be perfectly uniform, a constant pressure would be produced equal to 15 tons, or a body 15 tons in weight would be lifted one inch: but by making the eccentricity vary at different portions of the circumference, the pressure may be made ten times as great as here supposed at a particular point. It is scarcely necessary to add, that in this case it operates only through a tenth part of the space.

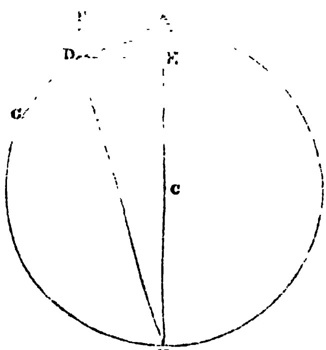
PROJECTILE AND GRAVITATING FORCES.

Sir,—Perhaps the best way of settling the question at issue between Majertingun and myself, will be to give the mathematical investigation of the following proposition, though I do not think myself bound by what he has advanced to do so, as his reply is any thing but the application of mathematical calculation to the phenomena of Nature; and I beg leave to observe, that though your Correspondent alludes to the analytical investigation by means of the fluxional calculus, it is my decided opinion, that when a problem can be resolved without such aid it is much better, as it is unnecessary to explain that

by principles difficult to be understood which admits of a solution by more obvious methods; and I think, if we can demonstrate the truth of the following proposition, Majertingun will be sufficiently answered.

Proposition.

When two or more bodies revolve at *equal* distances from the centre of their orbits, but with *unequal* velocities, the central forces (that is, the gravitating forces) necessary to retain them in their orbits will be to each other as the *squares* of their *velocities*, that is, if one body revolve *twice* as fast as the other, it will require *four* times the retaining force the other does, if with *three* times the velocity it will require *nine* times the retaining force to make them describe equal orbits.



Demonstration.

Let A D F represent a circle whose centre is C, and let A B be a tangent to the point A; now, let there be a body impelled by any force from A in the direction A B; let there be a force acting from the centre C on the body at A, which will tend to draw the body from A to C; and suppose these combined forces are such as to cause the body at A to revolve in the circumference of the circle A D F.

We will now estimate the force exerted to produce the deviation from a right line to a circular one. Let us conceive the point D very near A, and through D draw F D; then we may, as the points D and A are nigher to each other than any finite magnitude, consider the arc A D and the chord A D to coincide for an inconceivable small distance, and we may use the chord A D or the arc A D in our calculation as the same line; then A B will represent the projectile force, and A E the gravitating force, and the body will describe the arc A D by their united efforts; and as A E is the gravitating force or space the body has moved by virtue of the central force, it will be always proportional to the force itself. The value of that line or A E is now to be ascertained. Join the points D and F; then (by 31st of Euclid III.) the triangle A D F is right-angled at D, and, consequently (by the 8th and 6th of Euclid VI.), A E : A D :: A D : A F; hence $AE = \frac{AD^2}{AF}$: and as the arc A D and the chord A D are supposed equal to each other, we have $AE = \frac{\text{arc } AD^2}{AF}$, which is a correct expression, denoting the force of gravity necessary to retain a revolving body in a circle. Now, as the *space* a body would move in by the force of gravity is as the *square* of the *time* that action continues, let there be any other point, as G, in the circumference given, if we make $AD = t$, $AG = T$, and S the *space* the body would move in the time t, we shall have $t^2 : \frac{AD^2}{AF} :: T^2 : S$; then, as the motion of a body in a circle is uniform, we shall have $t : T :: AD : AG$; square this proportion, and we have $t^2 : T^2 :: AD^2 : AG^2$, or, altering the position of the first proportion, we have $t^2 : T^2 :: \frac{AD^2}{AF} : S$. Now, com-

paring these two together, we have $AD^2 : AG^2 :: \frac{AD^2}{AF} : S$, which, turned into an an equation, will be $S \times AD^2 = \frac{AD^2 \times AG^2}{AF}$, that is, $S = \frac{AG^2}{AF}$; that is, the space along which a body revolves in a circle is always equal to the *square* of the gravitating force divided by the diameter of the circle in which the body revolves. Hence it follows, that the central forces necessary to retain the circumference of a circle must be such as, if we suppose the projectile motion to cease, would cause the body to move towards the centre of the circle over a space or distance equal to the *square* of the arc of the circle described, divided by the diameter of the circle, and, consequently, in every case, will be proportional to the square of the arc the body would describe in a given time, divided by the diameter of the circle; and hence the *enegergy* of the central force is proportional to the *square* of the arc the body described in a given time, divided by the diameter of the circle. Now, if the velocity in the point A will carry the body to D in v times, it will carry it from A to G in 2 v times; but, supposing the velocity at the point A to be doubled, it will reach the point G in the same time as it would in the former case reach D. Now, as $v : 2v :: \frac{\text{arc } AD^2}{AF} : \frac{\text{arc } AG^2}{AF}$; that is, $v \times \frac{\text{arc } AD^2}{AF} = 2v \times \frac{\text{arc } AG^2}{AF}$, or $v \times$ arc $AD^2 = 2v \times$ arc AG^2, or $v : 2v :: AD^2 :: AG^2$; then, supposing the arc AD be assumed as unity, or 1, and the arc AG as twice its value, or 2, then we shall have this proportion, as $v : 2v :: AD^2 = 1 : AG^2 = 4$. Q. E. D.

The same kind of demonstration would have shown, that when the body revolves in any orbit, as the ellipse, parabola, &c., the same law holds good; but the calculation would have embraced some properties of the conic sections, which would have lengthened the calculation unnecessarily, and perhaps perplexed the general reader. I thought the investigation, as regards circular orbs, would be quite sufficient, and also because Majertingun seems to found his objections respecting them in particular; and shall here only add, that had we given the solution respecting other orbits, we should have had to consider the property of revolving bodies from that of their describing equal areas in equal times, instead of that of describing equal parts of the circumference in equal times.

Having now, I think, satisfactorily proved the proposition, I have only to thank Majertingun for his *valuable* reference respecting what Benjamin Martin says on the subject; and also that when he comes to the conclusion, that the *fluxion* of the projectile force infinitely exceeds the *fluxion* of the central force, he does not mean to assert that the central force is, in fact, nothing, or of no effect; for, if he did, it would be the same thing as asserting, that the projectile force is of *itself* sufficient to cause a body to revolve in a circular orbit, which is not even maintained by the Major himself.

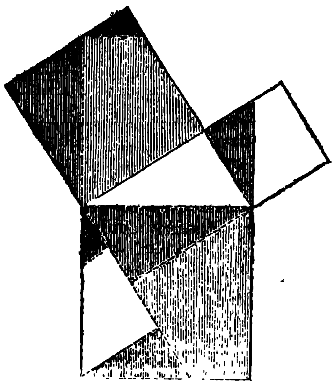
I shall conclude this paper with what I conceive to be the meaning of the fluxional expression, $\frac{\dot{z}^2}{d} = \dot{x}$, referred to in Martin's Mathematical Institutions, page 73, vol. II., which is simply, that the versed sine of an infinitely small arc is, in comparison of the radius, as a mathematical point is in comparison to any finite line, or as a fluxion is in comparison to a flowing quantity; for, as a point, which is of itself of no finite magnitude, may be conceived by its motion to generate a line, so may the combined efforts of the projectile and gravitating forces cause a body to revolve in the circumference of a circle, though the proportion they bear to each other may be less than any finite magnitude.

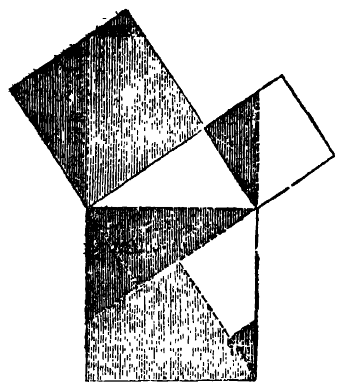
As to the calculations Majertingun wishes me to make, as they cannot tend to elucidate the subject, or answer any useful *practical* purpose, it would be only filling your useful pages, to the exclusion of what I have always thought and still believe to be of more benefit to mankind—the improvement of the mechanical arts; for it has always been my maxim to employ theory only where practice is likely to be benefitted by its application

I remain, Sir, &c.

Oct. 25, 1824. G. A. S.

MECHANICAL SOLUTION OF A MATHEMATICAL PROBLEM





Sir,—Presuming that a mechanical explanation of Euclid's far-famed and generally considered difficult proposition would be acceptable for your pages, I have, after some considerable trouble, formed two diagrams, which are so clear a proof that the two □, formed upon the base and perpendicular of a right-angled triangle, are, together, equal to a □ formed upon the hypothenuse, that I conceive this fact will be as evident to young mathematicians as it already is to the learned. The different shades of colour in the diagram show the parts which correspond with each other; and the whole may be proved correct by drawing the figure, and afterwards cutting it into the several pieces marked, and applying them to each other.

I am, Sir, &c.

Mechanicus.

EXPANSION OF WATER IN FREEZING.

Sir,—Your Correspondent, who calls himself "Gelidus," in your 62d Number, appears not to understand exactly the particular part of the law of the expansion and contraction of water, to which, in the article copied from *The Chemist*, the term "miracle" is applied. This is not the circumstance of *ice* occupying more space than *water*, for many other substances as well as water expand on crystallizing or changing from a liquid to a solid; but long before water begins to crystallize, it expands in cooling. Iron, mercury, and the other substances with which water may be surrounded, continue, after sinking to the fortieth degree, to contract as the cold increases, while it *alone* begins at eight thermometrical degrees, *before* it crystallizes, gradually to expand as it cools. It is obviously this fact, not the change of bulk in the act of freezing, to which the Editor of *The Chemist* applies the term *miracle;* and when all its beneficial consequences on the economy of nature are contemplated, though I cannot at present stop to enumerate them, it well deserves, not the *name* of a miracle, perhaps, for it is a *constant* result, but to excite our admiration and wonder. If your Correspondent, Sir, had read the "Mechanics' Magazine" with as much attention as I have, he would have recollected that Mr. Leslie's experiments on producing artificial cold are recorded in its pages. In these experiments the water freezes in the most complete vacuum we can create, and the more complete the vacuum the more speedy the congelation. I, therefore, beg leave to doubt that water absorbs air in freezing, and must still think that even the alteration of bulk which

takes place when some bodies change from liquids to solids, is not explained by your Correspondent's gratuitous assertion of "the *admixture of air.*" But although the general phenomena of *crystallization* were more happily explained than at present, the gradual expansion of water by cold, after it is cooled down to the fortieth degree, would still remain an *exception* to the general fact of all bodies contracting as they cool, to which even water itself, when above the fortieth degree, conforms.

I am, Sir,
Your most obedient servant,
T. H.

METROPOLITAN WATER-WORK COMPANY.

SIR,—Observing a project on foot for establishing a Company, to be designated the "Metropolitan Water-work Company," having for its object the supply of the metropolis with pure and wholesome water, to be obtained from the springs below the blue clay, about 35 fathoms depth, I may be entitled to make a few observations in favour of the project, though entirely unconnected with, and unknown to the projectors, on account of my having made a proposition to the Directors of the Imperial Gas Light Company, when their works were erecting, to the same effect, some two years since.

Being fully convinced, from the peculiar circumstance of water rising to the surface, or nearly so, in borings of from two to three hundred feet in depth, arising from its being confined below its natural level by an impervious clay, that we could, by being enabled to sink shafts to so great a depth, draw sufficiently below such level to ensure almost any supply; I took a favourable opportunity of suggesting to the Directors of the above Company a plan to that effect, and likewise for the employment of any extra power that might be required, beyond what would have been necessary for such purpose, which was to be effected by forcing water through pipes, and thereby conveying the power of the engines so as to act on, and give motion to, machinery at any distance—I say a favourable opportunity, because the necessary power might have been obtained from their works at little expense; and when they were erecting, it would have been an easy matter to have formed them for the double, or, I might say, the triple purpose.

From the great extent of these works, a number of large engines might be kept at work by placing boilers over the retort furnaces, if properly constructed for that purpose, whereby steam could be produced at little or perhaps no additional cost of fuel; hence the profit arising would be acquired at merely the expense of a few engine men, turncocks, wear, tear, &c. after the works were once completed, which would have enabled the Company to supply pure water at a rate much under any other, and render the concern one of the noblest of the kind ever undertaken.

I was not aware, when I made the proposition to the Company, that the late Mr Walker had entertained the same opinion as regards the supply of water, which, in the advertisement, he is stated to have done, and that he had reported thereon nearly six years ago; nor of the late Mr. Bramah's proposition to force water through pipes in the streets, from whence any person requiring small power might obtain it, until I saw it briefly noticed in a Magazine of this month.

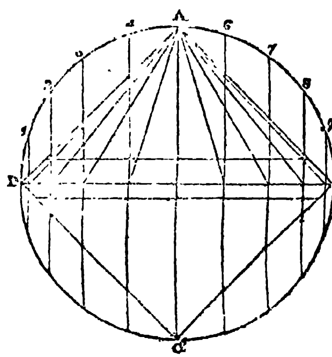
I am, Sir, yours, &c.
WILLIAM GILMAN.

N. B. In finishing the shafts, some little skill, ingenuity, and caution, will be requisite; for it must not be forgotten, that if we sink 200 feet below the natural level of the spring, that the pressure of the water upwards will be equal to 100lbs. per square inch over the whole area; so that the utmost care, to prevent accidents in their completion, and skill, with peculiar apparatus, to extract the whole body of clay left above the porous strata, after it is become unsafe for the workmen to remain below, will be necessary.

MECHANICAL GEOMETRY.

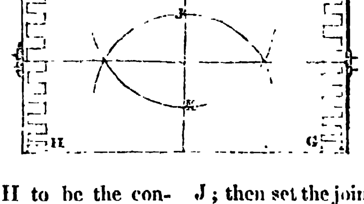
SIR,—Having received much valuable information through the medium of your useful miscellany, I think it my duty to contribute my mite for the increase of knowledge, and hope every one under the same obligation will pursue the same course. In addition to your generous Correspondents, G. A. S. and Massa' Jones, I send you the following diagrams, showing the application of Geometry to mechanical purposes, and its utility to the draftsman.

1st. How to draw the teeth of bevil-wheels in perspective.



Having determined the scale and number of teeth, draw the circle, A B C D (Fig. 1), whose diameter must be the same as the wheel; divide the arc, A, on the periphery, into half as many divisions as there are teeth in the wheel; divide the arc C into the same; then draw the chords, 1, 2, 3, &c., and their intersection with the diameter will show the point of the teeth; diagonals drawn from the intersections to A, which is the apex of a cone of which the wheel is the base, will give you the bevil of the teeth; draw the lines B D to C, and these will shape the back of the teeth.

2d. How to draw a line upon the surface of a cylinder, which shall be exactly parallel to the axis.



Suppose E F G H to be the contour of a cylinder; apply any point to the cylinder, whilst revolving at or near the middle, so as to describe a ring upon the surface, as at I; then set your compasses at any convenient distance, say at K, and make the arc J; then set the joint of your compass at J, and make the arc K; a line drawn through the intersection will be parallel to the axis.

I am, Sir,
Your obedient servant, R.
Manchester, Sept. 7th, 1824.

INTEREST AND DISCOUNT.

SIR,—As there cannot be a doubt, in the mind of any impartial man, of the Mechanics' Magazine being one of the most powerful assistants that the Arts and Sciences have, perhaps, ever been benefitted by, and as I have gathered from its pages many valuable suggestions, which I have adopted with success in my manufactory, I feel that it is incumbent on every one to forward its object to the utmost; as such, I trust you will, for the general benefit of all classes of tradesmen, afford this communication a place in your columns.

Amongst the various systems of doing business in this country, that of allowing large discounts upon goods has long been prevalent; and though affording a facility of adapting the prices to the fluctuations of the raw material, yet it is fraught with much perplexing calculation, and is frequently the source of ruin to many who are not adepts. If you have ever had an opportunity of investigating the "Tables of Discount and Profit," by John Evans, I think you will coincide with me in the importance of every one being possessed of them. I have used them constantly for nearly seven years, and consider it a most valuable work. The preface to these tables fully explains the deceptions of the system, in a style that renders it clear to the meanest capacity.

As it is to shopkeepers and the humbler classes of manufacturers, that I address this, scarcely one of whom but reads your Magazine, I would point out a few of the mistakes more particularly belonging to them.

For instance, a shopkeeper buys an article for 1*l.*, and sells it for 1*l.* 1*s.*, falsely supposing that he gains five per cent.; whereas he ought to get one shilling IN 20*s.* or five pounds IN, and not ON, 100*l.* Although many may consider this a trifling difference, yet where the profit is larger (say 20 per cent.), there is just five per cent. between the right and wrong mode of calculating it.

Again, discount is frequently an instrument of oppression in the hands of many of our merchants, factors, &c. The industrious mechanic, who expects, on Saturday night, to receive the fruits of his weekly labour, is told that "cash is scarce," and he cannot be paid unless he consents to allow five per cent. The poor man thinks this is but one shilling in the pound; but former extortions having amounted to perhaps 20 per cent., to which this last is added, he is not aware that he is sacrificing one shilling out of sixteen.

Some will add four shillings only to one pound, with a view of taking off 20 per cent. discount; but by deducting 20 per cent. off 24*s.* instead of a pound, they receive only 19*s.* 2½*d.*

I fear I have trespassed too much already, or I could adduce mistakes out of number which daily occur; but as it behoves me to be brief, I shall content myself with advising my fellow-tradesmen to avail themselves of this work as a guide and a preventive of error.

I am, Sir, &c.

A CONSTANT READER.

Birmingham, Oct. 7, 1824.

We have since been favoured by our Correspondent with a sight of the work itself; and, after an attentive examination, fully concur in the praise which he has bestowed upon it. We quote from the preface the following additional illustration of the common errors arising from the confounding of interest with discount.

"Interest and discount have been confounded together, and by many considered as one and the same operation. No such analogy will, however, be found between them: interest consists in the addition of so much per cent. to the principal; discount is a reduction of the principal. It is evidently a mistake to suppose that, by adding the interest to a given sum, at a certain percentage, we enable it to sustain the reaction of the same rate per cent. discount, because the discount is not only taken off the principal, but likewise off the

sum added to it. For instance, five per cent. added to 100*l.* increases it to 105*l.*; but take five per cent. from 105*l.* there remains only 99*l.* 15*s.*—occasioning a loss of five shillings, or one quarter per cent.

"The proper mode of adding a profit or a discount is as follows:—

Principal					-	£100	0	0
Add five per cent. on	£100	0	0	-	is	5	0	0
Ditto	on 5	0	0	-	is	0	5	0
Ditto	on 0	0	5	-	is	0	0	3
Ditto	on 0	0	3	-	is	0	0	0¼
						£105	5	3¼

Which sum will allow of five per cent. being taken off, and still leave the original principal, 100*l.*, unimpaired.

"Although the difference in the above example is trivial, yet it becomes more serious in proportion to the increase of the percentage. To cover a discount of 20 per cent., 25 per cent. interest must be added; and to sustain 50 per cent. discount, the principal must actually be doubled."

ELLINGTON'S LOCK.

Sir,—I should have written to you before, in order to expose the fallacy of Mr. Ellington's statement respecting what he terms his new-invented Lock, but was in hopes some one else would have relieved me from the unpleasant task; but as no one has hitherto taken up the subject, and I perceive that the lock has been inquired after by several of your Correspondents, I shall beg leave, with your permission, to assure them, that if Mr. Ellington's drawings are correct, it is a most insecure lock—indeed, I do not know of any, except the very commonest kinds that are made, that may be so easily opened. For instance, what is to prevent any person from taking a common key, near the size, and (after filing off the bitt of a broken key, or a piece of hollow tube will do as well) notching it down at right angles (see his drawing), by which a child may open it with perfect ease. Besides, neither this principle, nor that of the revolving tumbler, are new: to my knowledge they have been applied to locks for more than twenty years. Common padlocks and other kinds have been long made on the same principle. The lock may answer as a cheap one for common purposes, but it would be highly unwise to trust valuable property to so very insecure a protection.

I am, Sir,
Your humble servant and reader,
T. J.

P.S. As a *good* and cheap lock, I would recommend your Correspondents to get Barron's patent: it may be procured at most of the ironmongers, and has stood the test of many years experience. Should the size of the bitt be an objection, there is an improved sort made, with a brass barrel on the cap-plate and very small bitt, which may be worn at the watch chain.

PLAN OF IRON COLONNADING.

Sir,—Mr. Wedderburgh must not arrogate to himself the merit of being the first to propose a plan of Iron Colonnading, as the idea is derived, pretty evidently, from the Circus at the west end, or from the Piazzas in various parts, of the town. Indeed no part of it is original, for, if he claims the cast iron part of the subject, I would beg leave to refer him to the Circus pillars, which are of cast iron. Nay, his whole plan has been long executed in the colonnade round the Finsbury Market, which, Heaven knows, is no improvement to the place. I will shortly endeavour to prove that he plan would not be productive of such benefits as he vainly imagines.

I am, Sir,
Your obedient servant,
Anti-Colonnade.

Oct. 16, 1824.

ON THE CONSTRUCTION OF STEAM VESSELS.

SIR,—As a ship-builder, my attention is, of course, attracted by any thing relating to naval affairs, particularly to the propelling of vessels, whether by wind or otherwise; and I am sorry to observe so much waste of power, whenever steam is applied as the propelling force. I am led to make these remarks from observing, in all the steam vessels I have seen, that the paddle-wheels, instead of getting firm hold of the water, and thereby communicating their entire force, or nearly so, to the vessel, are constructed so narrow, and the floats so close together, as to drive the water aft to such a degree, that it runs under the quarter at the rate of eleven or twelve knots, whilst the real progress of the vessel is but six or seven knots, showing a loss of nearly 50 per cent. This might, in a great degree, be avoided, by making the paddle-wheels of greater breadth, and placing the floats five or six feet apart, instead of three feet, or thereabouts, as is the practice now. The paddle-wheels of a steam vessel ought to be considered as a pinion working in a rack, and the strength of the rack is but in proportion to the cubic contents of the water between the floats; it is therefore evident, that if the space between the floats contain eighteen cubic feet on the present system, and the floats were removed to five feet, the floats would act against a body of water that would offer two-thirds more resistance (supposing the breadth of the wheels to be the same), and, of course, act on the vessel with two-thirds more power than before, which, of course, would increase the speed of the vessel through the water. It may be objected, that the strokes would be slower, and therefore the vessel would not move any faster. This is a mistaken idea, and is contrary to experience; as persons conversant with nautical affairs well know, that, in rowing, it is not the quickness of the stroke, but the length of it, as it is technically termed, that propels the boat fastest through the water. The form of the vessel is also of great importance, particularly the bow and quarter. The present prevailing mode of giving steam vessels so much rake forward, is, I am convinced, injudicious, particularly for those which go to sea, as it, of necessity, renders it much bluffer, and presents a surface nearly at right angles with the direction of the sea, which, of course, has then its greatest power, and impedes her progress. Another serious disadvantage is, that it has a tendency to drive the water up before it to the height of several inches, which is equal to an increased draft of water of so many inches, besides giving a form to the bow which cannot divide the fluid with so much ease as is experienced in the case of a more upright stern. This will be evident on comparing the sections of the two bows, taken in an angle of 30 or 35 degrees from the keel, which is nearly the direction of the water from the fore-foot to the surface. The form of the quarter is also of great importance both to the steerage and velocity of the vessel. As these vessels have no sails to assist the steerage, the quarter should be fine, so as to give easy steerage, and allow the water to leave, without those eddies so frequently seen under the quarter.

I trust you will pardon my trespassing on your valuable pages to this extent, and hope these remarks will draw the attention of persons more able than myself to the subject, that our practice in ship-building may be improved, so that our vessels may excel in speed all others.

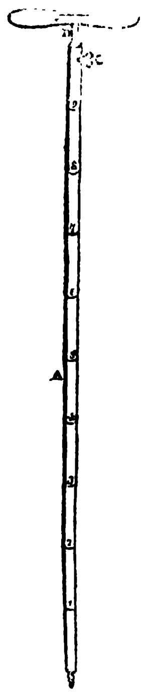
I am, Sir, yours, &c.

Ipswich. GEORGE BAYLEY.

VELOCITY OF HAMMERING.

SIR,—Many of your readers are in the daily practice of using a *hammer*; perhaps few of them have troubled themselves to ascertain the *velocity* with which they are able to strike any material with the hammer. From experiments made with hammers of various weights, I have found the velocity not to exceed above 60 feet per second; and that a velocity between 15 and 30 feet per second may, without much error, be considered the usual velocity. B. BEVAN.

EARTH BORER.



Sir,—The Borer, a sketch of which is placed above, has been found useful in ascertaining the nature of the soil for the foundations for masonry, in the formation of quay walls and piers at Bridport Harbour. A is a tube, about ten feet long, formed of old gun-barrels firmly soldered; B, an iron rod, fitted to the tube, and fixed in handles similar to the ,e of an auger, the point of the rod projecting almost two inches below the end of the tube; C, a screw, which, turned by the thumb and finger, keeps the rod in its proper place. The instrument is bored into the loose sand or soil to any depth within its length, which depth is shown by the scale marked on the tube; the screw is then loosened, and the rod withdrawn four or five inches, and again fixed. The instrument is then bored to a further depth, and the tube receives a portion of such stratum as it may have perforated, and the instrument being withdrawn altogether, retains such portion as is forced out for examination by restoring the rod to its original position. I am not aware that this simple invention has the merit of originality; but if it have not, it may, through the medium of your useful publication, become more generally known.

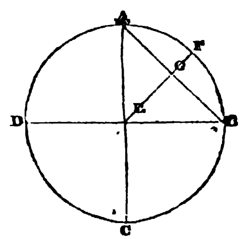
I am, Sir, &c.

E. Nicholetts.

Bridport, Sept. 20, 1824.

MEASURING CIRCUMFERENCES.

Sir,—It may be useful to your eaders to know that the circum-ference of a circle may be found with great practical accuracy with a common pair of compasses by the following easy process:—



Divide the circle (or any given circle) into four equal parts, A B C D; draw a line from A to B; divide the quarter of the circle, A B, in half, E F. Now, three times A C, and once F G added thereto, gives the length of the circle A B C D within the 1-4000th part of the said circle. A less angle would, of course, give a greater approximation, but would be less easy to the uninformed artisan. In words the fact might be stated thus:—

Three times the diameter and once the versed sine of the angle 45° gives the circumference within the 1-4000th part.

I am, Sir,

Your obedient servant,

H. C. Jennings.

Devonshire-street, Portland-place,
Oct. 1, 1824.

COPPER SHEATHING.

Mr. Children, one of the Editors of the Annals of Philosophy, has given, in the last number of that publication, an article on certain mistatements which have appeared in the Newspapers respecting Sir Humphry Davy's method of protecting the Copper Sheathing of Ship's Bottoms, and which were partially adopted in our own pages. Mr. Children, as we noticed in our 60th Number (page 51), had himself said that the defended metal is more liable to become foul from the adhesion of weeds, barnacles, &c. than the undefended; but he now informs us, that more accurate inquiries have convinced him that he should have been more guarded in admitting the fact as a general result, the assertion requiring much qualification to make it consistent with truth. The following Mr. Children states to be the actual result of the experiments which have been made :—

"The two harbour-boats, which gave rise to the original exaggerated account (that vessels had returned after short voyages with their bottoms completely covered with barnacles, weeds, &c.), *were purposely pre-defended* by a surface of zinc in the proportion of about 1-25th of that of the copper; the object of these preliminary experiments being solely to ascertain the *efficacy of the plan as a preservative of the copper*, without reference to any ulterior effects. These boats were stationed in Portsmouth Harbour, and the copper remained bright for nearly three months, when it became coated with carbonate of lime, to the rough surface of which the confervæ, always floating in the summer months in Portsmouth Harbour, adhered; and these soon caught other weeds, but they were all *loose, and there were neither barnacles nor any other shell-fish, nor any worms*, amongst them; and it is more than probable that the same weeds would have adhered even to carbonate of copper."

Mr. Children adds—"Except in harbour, there is every reason to think that carbonate of lime could not adhere to the copper, *even with excess of protection*, and the confervæ must have been washed off in a ship at sea. Copper, until it is worn in holes, corrodes so fast, that no permanent surface remains to which weeds can adhere; but when there are inequalities on the surface, they adhere readily enough even to the poisonous oxide of the copper. I do not believe that any of the protectors placed upon ships are in such excess as to occasion any deposit; and if they are a little positive, or nearly in equilibrio, the whole surface remains smooth, and the adhesion of weed and shell-fish is prevented. As far as the experiments hitherto made enable one to judge, the requisite proportion of protecting surface to that of the copper is somewhere between 1-120 and 1-220; but even 1-300th will save more than half the copper of the navy."

A letter from Mr. Barrow, Under Secretary to the Admiralty, is added, corroborative of Mr. Children's statement.

Thus far Mr. Children. But that his defence or explanation is any thing but satisfactory, may be seen from the following letter, which we have received on the subject from Sheerness Dock-yard, and which we deem it due to the cause of truth to insert.

Sir,—In the last Number of the "Annals of Philosophy," there is an article by Mr. Children, the champion of Sir Humphry Davy, on the subject of Ships' Bottoms, and his trip to Norway With the former only you have to do. And,

1st. Mr. C.'s account of the "two pre-defended" boats in Portsmouth Harbour, is to be met by this fact, that in this dock-yard six vessels have been "Davied;" two of which, the Gloster and the Howe (the former at anchor since the 12th of July last, and the latter since the 30th of April—both too in a *rapid tide*), are as foul as it is possible for ships to be; much more so, indeed, than any other vessel in this harbour, being covered with echinæ, barnacles, weeds, worms, muscles, &c.

2nd. This principle of Sir H. Davy's is to preserve copper from decay: but what are the effects resulting from the *attachment* of those animals? Do they not adhere for *subsistence?* and if so, must they not *destroy?*

3rd. Mr. Children says, that "except in harbour, carbonate of lime could not adhere to the copper." Now this is a harbour *with a tideway*, and yet carbonate of lime does adhere.

4th. Mr. Barrow's evidence on the subject merely amounts to this, that the ships on which the experiments have been made have "not been reported."

I think it would be well in the Admiralty to pause before any more vessels are "David."

I am, Sir,
Your obedient servant,
SPYGLASS.

Sheerness Dock-yard, Nov. 1.

GOOD WAX.

The best Wax from the comb is that which smells strongest of the honey, and is yellowest in colour. Both the flavour and colour become diminished by age.

INQUIRIES.

NO. 75.—GOTHIC ROOFS.

How were the stones placed in forming a Gothic arched roof, and to fill up the cavities over it?

NO. 76.—NAPIER'S BONES.

SIR,—Being applied to, some time ago, to purchase a set of Napier's Bones for a friend, and having inquired for them at many places without success, I shall feel obliged if any of your Correspondents can direct me where to meet with them *in box-wood*. I have a set by me, made by the late ingenious Imison, which I invariably use when engaged in long numerical calculations. The relief they afford under such circumstances, makes me regret that an invention so mechanical, and truly useful, should be suffered to sink into oblivion. The operations of multiplying, dividing, and extracting roots, are, by the help of the numbering-rods, performed with ease and expedition, and without any fatigue or burden to the mind. A description of them, I should think, would be very acceptable to many of your numerous readers.

I am, Sir,
Your obedient servant,
LEGIS.

[The description desired shall be given in our next.—ED.]

NO. 77.—STEAM-PIPE JOINTS.

SIR,—I should feel obliged to any of your intelligent Correspondents to inform me which of the different methods, now in use, they consider the best for putting together the joints of Steam-pipes. I have seen mill-board and white-lead, as also iron-cement, make very good joints for pipes of not more than six or eight inches diameter, but both those methods fail in pipes of one foot diameter, when I have seen what is generally termed, by engineers, a gaskin, that is, long hemp mixed with white-lead, and platted, applied, which has made a tight joint.

A receipt to make a good iron-cement is much wanted.

I am, Sir,
Your obedient servant,
Henley-on-Thames. J. T.

ANSWERS TO INQUIRIES.

NO. 73.—SHARPENING KNIVES.

SIR,—Care should be taken that the surface of the hone is free from grit or dirt, and, having applied the oil, move the blade flat on the hone, circularly, on each side for a minute or two; which done, draw the blade gradually from heel to point four or

five times, edgewise, or, to express myself more familiarly, as if forming the segment of a circle; this latter will entirely remove what is termed wire and (by repetition) small notches.

I am, Sir,
Your constant reader,
EDMUND.

St. Martin's, Oct. 25th, 1824.

NO. 8.—PRIME NUMBERS.

SIR,—In answer to "Abacus," a Correspondent, in one of your Numbers, p. 93, vol. I. I would suggest the following method to ascertain whether any number, from 1 to 10,000, that may be proposed, be a Prime Number.

Find the least, or any other common multiple, of all numbers from 1 to 100: if the greatest common measure of this common multiple and the number proposed be 1, the number proposed is a prime. This applies to all numbers from 100 to 10,000. Should, therefore, the proposed number be between 10 and 100, use a common multiple of the series from 1 to 10. I might add a rule to find the primes under 10, were they not readily found.

The above method, it is clear, might be extended so as to apply to any number, however great, above 10,000, by using a common multiple of a corresponding series of figures; and perhaps some of your Correspondents may favour us with a common multiple of a series sufficiently extended.

I am, Sir,
Your obedient servant,
JAMES TROUP.

High-street, Borough.

CORRESPONDENCE.

We shall be glad to meet the friend of W. E. at 55, Paternoster-row, any day after Wednesday next that he will appoint.

A "Constant Reader" will please send to our publishers' for the Book which he wished returned to him; and, to prevent mistakes, say, in a note addressed to our publishers, what the name of the book is.

T. M. B. is again all *vox et præterea nihil.* We intend to give a description of the instrument, with an inspection of which he favoured us in the days of his impartiality; and beg, therefore, to retain it in our hands a little longer.

J. P**, under particular consideration.

Messrs. T. Bailey and Co. have our best thanks. A description will appear soon.

Mr. Yule will please send to our publishers' on Monday, for a letter addressed to him.

Communications received from—A Millmaker—Richard Dowden (should have been sooner acknowledged)—J. D. —Thomas Deakin—S. Clear—A Dublin Subscriber—Aurum—T. S. D.—Mr. Coles —Jas. Moon—M. A.—A Country Reader —S. P——r, Jun.—Pivot - Menander - John Young—W. V.—Nathan Short— F. M. F.—Joseph Hall—Rob Roy—Simon—B. P. C.—Wm. H. C.—E. D.— M. T. J. I.—Observator (who shall hear from us shortly)—B.—A Correspondent at "Norton, near Stockton" - Juvenis - Experiment—B. B.

An "Old Correspondent" speaks highly of an Explanatory Dictionary, by a Practical Chemist, of the Apparatus and Instruments employed in the various Operations of Philosophical and Experimental Chemistry, which is to appear shortly, with seventeen quarto copper-plates; Mr. Boys, Ludgate-hill, publisher. When we see it, we shall be able to judge whether the praise bestowed is well merited.

ERRATUM.

P. 91, vol. III. The letter *m*, in fig. 1, is misplaced. It will, however, be readily rectified by any one who takes the trouble of reading the demonstration.—N. S.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by B. BENSLEY, Bolt-court, Fleet-street.

Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

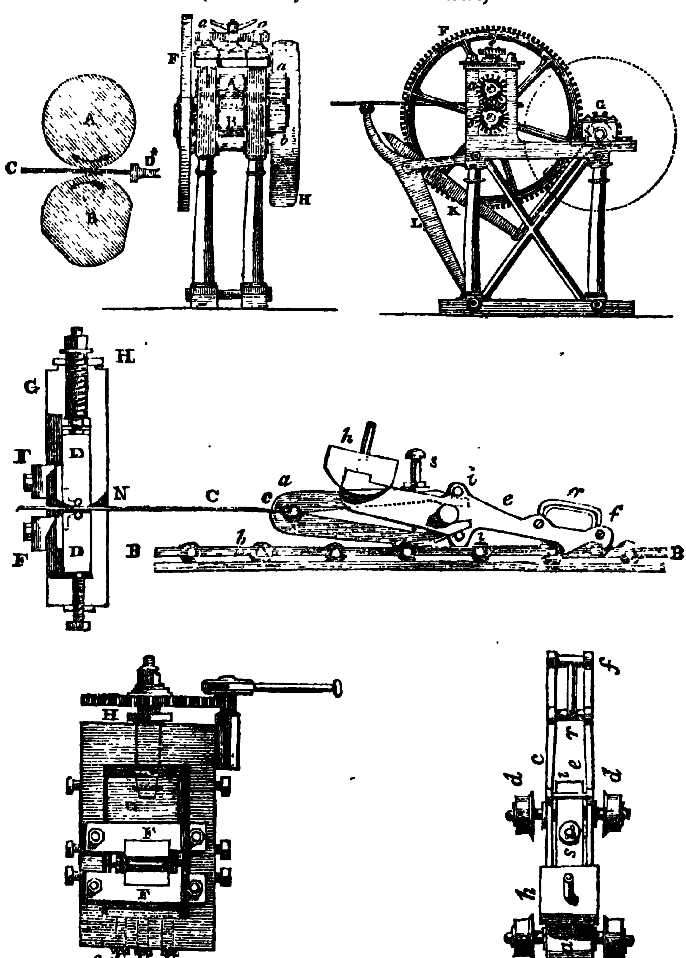
"The most valuable gift which the Hand of Science has ever yet offered to the Artisan." *Dr. Birkbeck.*

No. 64.] SATURDAY, NOVEMBER 13, 1824. [Price 3*d*.

"It is better to be unborn than untaught; for ignorance is the root of misfortune."—*Plato.*

PROCESS OF COINING AT THE ROYAL MINT.

(Continued from our last Number.)



PROCESS OF COINING AT THE ROYAL MINT.

The Drawings given with our present Number are descriptive of a new machine, invented by Mr. Barton, and employed at the Royal Mint for drawing the slips of metal between dies, by which a greater degree of accuracy and uniformity is obtained in the thickness of the metal. The operation is similar to wire-drawing.

The first, second, and third of the preceding figures, represent a small machine for thinning the ends of the slips of metal, so that they will enter into the dies through which the whole of the slip is to be drawn. It is a small pair of rollers, which are shown on a large scale in figure 1st. A is the upper roller, and B the lower; this has three flat sides, as represented: C is the slip of metal put between the rollers; D is a stop, adjustable in the line of the motion of the slip of metal, C. The second figure is an end view, and the third a side view, of the frame or machine in which the rollers are mounted. AB are the rollers, which are made to turn together by pinions, *a b*. F is a large cog-wheel, which is fixed on the end of the axis of the lower roller. This cog-wheel is turned by a pinion, G, which is fixed on an axis extending across the machine, and having a fly-wheel fixed on one end, and at the other a drum, H, to receive an endless strap, by which the machine is put in motion; a crank is formed on the middle of this axis, and a rod, *d*, is joined to the crank, to connect it with the moving blade, K, of a pair of shears, of which the other blade, L, is fixed to the frame. The distance of the rollers is regulated by a screw, *e e*, at the top of each standard. These screws have pinions at the top of them, and are turned round by a pinion, which is placed between them, and engages the teeth of both pinions, so as to give motion to the two screws at the same time, when the middle wheel is turned round by a cross handle which is fixed to the top of it. If the slips of metal which are to be put into this machine are not exactly square at the ends, they are cut off smooth and square by the shears, which keep constantly moving; the end of the slip is then presented between the rollers, not on that side which would draw them in between the rollers, as in common rolling, but on the opposite side; when one of the flat sides of the lower roller comes opposite the upper roller, then the piece of metal can be pushed forwards between the two, until the end stops against the stop D, as in fig. 1st.; then, as the rollers turn round, and the flat side of the lower roller passed by, the cylindrical parts of the roller will take the metal between, and roll it thinner at the end which is between the stops and the point of contact of the rollers.

Figures 4 and 5. A section, to show how the slip of metal, C, is drawn between the dies, fig. 4, by the tongs, fig. 5. The dies are two cylinders of steel, made very hard, and extremely true; these are fitted into two sliders, DD, and are held fast by clamp pieces screwed against them. The steel cylinders are very accurately fitted into their beds in the slides, so that the steel shall be firmly supported, and prevented from bending or turning round, and presenting but a small portion of their circumference against the slip of metal. The sliders, DD, are fitted into a box, figures 4 and 6; they fit flat on the bottom of the box, and two clamps, FF, are screwed against the sliders, to confine them to the box. The lower slider is supported by two screws, *f f*, and the upper slider is forced down by a large screw, G; this has a cog-wheel fixed on the top of it, with a pinion and lever to turn the screws round very slowly, and regulate the distance between the dies. H is a clamping nut, fitted upon the screw, to take off all possibility of shake; the sliders also are bound fast sideways by screws tapped through the sides of the box, the points of which press upon steel plates between them and the sliders. In order to render the contact between the points of the screws, supporting the under side, and the point of the adjusting screw, forcing the upper slider, still more complete, two extending screws are introduced at the ends of the steel dies between the sliders, by which a sufficient degree of contact to overcome the spring of the materials may be excited before the dies come into action on the slip of the metal.

Our Artist has in hand, for next Number, a perspective view of the drawing-machine at work. The box of dies is fixed at one end of a long frame. This frame supports two axes, AA, one at each end. Upon these axes wheels are fixed, to receive endless chains, BB, which move along a sort of trough or railway, formed on the top of the frame. The chains are kept in motion by a cog-wheel, C, which is fixed upon the axis most remote from the box of dies. This cog-wheel is turned by a pinion D, on the axis of which is a wheel E; and this wheel is turned by a pinion F, on the axis of the drum G, which is moved by an endless band, proceeding from some of the wheels in the mill, and which is thrown in and out of geer at pleasure by a tightening roller. The slip of metal is drawn through the dies by the chain, with a pair of tongs.

Figures 5 and 7—*a b* are the two jaws of the tongs, which are united with each

other by the joint pin *c*. This has a small roller or wheel fitted on each, and to run upon the railway or top of the frame; *d d* are a similar pair of wheels, the axle of which is connected with two links *e e*; this axle passes between the tails of the tongs, but is not fixed to them. The ends of the links have a double hook formed on them, as shown at figure 5. The tongs run upon their wheels immediately over the endless chain, so that when the end of the links, *e e*, is pressed down, one of the hooks catches on a cross pin of the chain, as in figure 5; the axle of the wheel *d d*, acting between the inclined parts of the tails of the tongs, tends to throw them asunder, and, at the same time, the jaws of the tongs bite with very great force; the links *e e* draw the tongs along with the chain BB. The links are carried a long way beyond the axle of the wheels, and have a sufficient weight, *h*, fastened to them, which will lift up the hooked end *f*, and disengage it from the chain, except when there is a considerable strain on the tongs.

To use this machine, a boy takes hold of the tongs by the handle *r*, when they are disengaged from the chain, and pushes the tongs forward to the box of dies. The tongs run freely upon their wheels, and the jaws open when moved in that direction, because two small pins, *i i*, are fixed between the links, and acting on the outsides of the tails of the tongs, close them together, and this at the same time opens the jaws. The tongs are pushed up close to the box of dies, and the jaws enter into a recess N, figure 4, which is formed for that purpose. Another boy takes a slip of metal, which is previously made thin by the rollers, figure 1, and introduces it between the dies, and also between the jaws of the tongs, which are open. The boy who holds the tongs now takes the handle *s*, which is fixed on the back of the tongs, and holds it fast, whilst with the other hand he draws the handle *r*, at the end of the links, away from the tongs. This has the effect of closing the jaws of the tongs upon the slip of metal between them; at the same time the boy depresses the handle *r*, and the hook at the end of the links, *e e*, will be caught by the first cross-pin of the chain which comes beneath them. This puts the tongs in motion; but the first action is to close the jaws, and bite the piece of metal with great force, in consequence of the axle-tree of the wheels being placed between the inclined planes of the tongs. When the tongs have closed on the metal with all their force, they move with the chain, and draw the slips of metal through the dies, which, operating upon the thicker part of the slip with greater effect than upon the thin, reduces the whole to an equable thickness. When the whole is drawn through, the strain upon the tongs is gradually released; and the weight lifting up the hook at the other end of the links, they are ready to be advanced again to the die, to draw another bar. The frame, of which we are to give a drawing in our next Number, contains two pair of dies, and the same wheel serves for both. At the Mint there are two machines of this description: they are placed side by side, with a sufficient space for the boys to work between them. These machines were made by Mr. Maudsley, under the direction of the inventor.

The slips of metal produced from this machine are considerably more uniform in thickness than when finished at the adjusting rollers; consequently the individual pieces are made more nearly to the standard weight, which was the object in view by this invention. This has become a point of great importance in the practice of the Mint, from the remedy on gold in weight being reduced from 40 to 12 Troy grains. When the pieces cut from slips of metal prepared from the drawing machine are pounded and weighed, which is telling the number of pieces in a pound Troy, sovereigns or half sovereigns, the variations from standard either way seldom exceed three grains Troy. It is reckoned good work from the adjusting rollers when the variations are under six Troy grains.

(To be continued.)

THE COLUMBUS.

We have now had the gratification, which we so confidently anticipated, of seeing this immense vessel safely moored in the Thames. She left Quebec on the 5th of September, and continued her course in safety till the 9th, when she took ground on the north side of the river St. Lawrence. A portion of her cargo being thrown overboard, she was got off without any material damage on the 12th of September; and after a very boisterous passage across the Atlantic, she made the Scilly Light on the evening of the 29th October. For a week before making land, the pumps were required to be kept constantly going. On November 1, she arrived in the Downs, whence she was towed by the James Watt, Tourist, and Soho, steam-vessels, up to Blackwall.

Another vessel, of still greater dimensions, is building on the same slip as the Columbus at the Isle of Orleans. She is said to be registered for 5050 tons.

TABLE OF CANDLELIGHT (MEAN TIME).

(Continued from page 413, *Vol. II.)*

	OCTOBER.		NOVEMBER.		DECEMBER.	
Day.	End. Morning. h. m.	Begin. Evening. h. m.	End. Morning. h. m.	Begin. Evening. h. m.	End. Morning. h. m.	Begin. Evening. h. m.
1	5 31	6 9	6 22	5 6	7 8	4 30
2	5 32	6 6	6 24	5 4	7 10	4 30
3	5 34	6 4	6 26	5 2	7 11	4 29
4	5 36	6 2	6 28	5 0	7 12	4 28
5	5 38	6 0	6 29	4 59	7 13	4 28
6	5 39	5 57	6 30	4 58	7 14	4 28
7	5 41	5 55	6 32	4 56	7 15	4 28
8	5 43	5 53	6 34	4 54	7 16	4 27
9	5 45	5 51	6 36	4 52	7 17	4 27
10	5 46	5 49	6 37	4 51	7 19	4 27
11	5 47	5 47	6 39	4 59	7 20	4 26
12	5 49	5 45	6 40	4 48	7 21	4 26
13	5 50	5 42	6 42	4 47	7 22	4 26
14	5 52	5 40	6 43	4 46	7 23	4 27
15	5 53	5 38	6 45	4 45	7 24	4 27
16	5 55	5 37	6 47	4 43	7 24	4 28
17	5 57	5 35	6 48	4 42	7 24	4 28
18	5 58	5 32	6 50	4 41	7 24	4 29
19	6 0	5 30	6 51	4 40	7 25	4 29
20	6 2	5 28	6 52	4 40	7 25	4 29
21	6 4	5 26	6 54	4 38	7 25	4 29
22	6 6	5 24	6 55	4 37	7 26	4 30
23	6 8	5 22	6 58	4 36	7 28	4 30
24	6 9	5 20	6 59	4 35	7 29	4 31
25	6 10	5 18	7 0	4 34	7 29	4 31
26	6 11	5 17	7 1	4 33	7 30	4 32
27	6 13	5 15	7 3	4 33	7 30	4 32
28	6 15	5 13	7 4	4 32	7 31	4 33
29	6 17	5 11	7 5	4 31	7 31	4 34
30	6 19	5 9	7 7	4 31	7 31	4 35
31	6 20	5 8			7 31	4 36

SIR,—I have sent you the last Quarter's Table of Candlelight, which finishes the year, on which I beg to observe, that they are adapted to *mean* or clock-time, and will serve for several years, and for most of the middle and southern counties of England, and will prove within one or two minutes of the time in fine weather, and in rooms not made dark by other buildings or trees. In cloudy weather a small allowance will be necessary, varying from nine to twelve minutes, but, in general, ten minutes will be sufficient for most practical purposes. In confined situations it will not be difficult to determine the number of minutes to be subtracted in the evening, or added in the morning, to make the Tables fit any particular place.

I am, Sir,
Your obedient servant,

B. B.

CALCULATING PRICE OF TIMBER.

SIR,—I have a way of calculating the price of 120 deals, or a long hundred, by the price of one deal, which, I think, is rather shorter than that presented by your rules in No. 57.

A customer says to me, 'What is the price of your 12-feet deals?' My reply is, 'Seven shillings and sixpence each. He rejoins, 'I do not want to buy them by the piece—what is the price per hundred?' I make the calculation *mentally*, calling the SHILLINGS POUNDS, and the pence aliquot parts of a pound, and multiplying by 6. Thus 6 × 7 is 42, and 6*d*. is the half of 6, which makes 45*l* per hundred of 120.

Suppose the deal is 7*s*. 4*d*.	- - 6 × 7 =	42
1-3rd of 6*l*. is	- - - - - - -	2
		44*l*.
A deal at 8*s*. 1*d*.	- - - - - - 6 × 8 =	48
1-12th of 6*l*. is	- - - - -	10
		48*l*. 10*s*.
A deal at 7*s*. 9*d*.	- - - - - - 6 × 7 =	42
3-4ths of 6*l*. is	- - - - - - -	4 10
		46*l*. 10*s*.

Now, to show that your rules are correct, in opposition to what is advanced by a Correspondent, in No. 60, I will work this exercise back into hundreds.

120 deals at 46*l*. 10*s*. - - -	or 46½ ×2 = 93	- - is 93*d*.	- - 7*s*. 9*d*.
120 deals at 48*l*. 10*s*. - - -	or 48½ ×2 = 97	- - is 97*d*.	- - 8*s*. 1*d*.
120 deals at 44*l*. - - - -	or 44 ×2 = 88	- - is 88*d*.	- - 7*s*. 4*d*.
120 deals at 45*l*. - - - -	or 45 ×2 = 90	- - is 90*d*.	- - 7*s*. 6*d*.

I have a method which, I believe, is peculiar to myself, of calculating the price of timber sold by the load of 50 cubic, or 600 superficial feet; likewise a shorter mode of casting up sawyers' work, than I have seen used by any other person, which I should be very happy to lay before the public, if you think it worth while.*

I am, Sir,
Your obedient servant,
A TIMBER MERCHANT'S FOREMAN.

* We shall be glad to receive them. —EDIT.

ON THE VERIFICATION OF THE WORK IN EXTRACTING ROOTS.

SIR,—Several years ago I met with a method of proving the Square and Cube Roots, by Mr. Taylor, of Wakefield, in that excellent work, "The Leeds Correspondent." The principle is essentially the same as the well-known process for proving multiplication by casting out the nines. I have used it for several years as a check upon my calculation in the extraction of roots, as well as for the proof of operations in multiplication and division. I enclose an in-

vestigation of the principles and the practice of the rule, which, I have no doubt, will be acceptable to those of your readers who are unacquainted with it, and can assure them that it will be of essential use in checking their operations in long extractions.

I am, Sir,
Yours truly,
T. S. D.

Bath, October 8th, 1824.

Investigation.

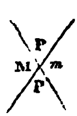
Let $(9A+a) \times (9B+b) \times (9C+c) \times$ ..... represent the n factors of which any number is composed; then, by actual multiplication, we obtain for the product of these quantities, a series of terms, all of which, except the last, are multiples of nine. The last term will be $a.b.c.$ ... to n factors, which also the product of the original excesses above, some multiples of nine in the factors, from which we set out; or, in other words, the overplus of the nines in the general product is equal to the continued product of the separate excesses in the component factors of that general product.

Cor. 1.—If $(9K+k)$ be any number whatever added to the general product, and the excess, k, of its nines be added to the continued product, $a.b.c....$, of the respective excesses of its factors, the excess of nines in $(9A+a) \times (9B+b) \times (9C+c) \times$ .... $+ (9K+k)$, will be equal to the excess of nines in $a.b.c.....+k$.

Cor. 2.—If $A=B=C=....$, and $a=b=c=.....$, then we have $(9A+a)^n = 9Z+a^n$, and $(9A+a)^n + (9K+k) = 9Z'+a^n+K$; and, consequently, the excess of nines in the former numbers of these two equations equal to the excess of nines in a^n+k.

PRACTICE OF THE CHECKS.

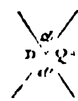
1. *For Multiplication.*



Draw the oblique or St. Andrew's Cross, as placed immediately above; add together the figures composing the multiplicand, subtract from this sum the highest number of nines contained in it, and set the overplus in the angle marked M. Do the like with the multiplier, and set its overplus in the angle m. Set the overplus of the nines in the product in P; and, if the overplus of nines in the product P′ of M and m be equal to P, the work is *presumed to be right*: if not equal, the work is *certainly wrong*.

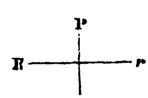
Note.—If either M or m be discovered to become 0, the other need not be calculated, as P must in that case be 0, when the work is right.

2. *For Division.*



Draw the cross as before: put the overplus of the nines contained in the sum of the figures composing the dividend in d, of those in the divisor in D, of those in the quotient in Q, of those of the remainder in R (annexed to Q by the sign of addition). If to the product of D and Q we add R, and the excess of nines, d', in the result, be equal to d, the work is presumed to be right, otherwise it is certainly wrong.

3. *For the Extraction of Roots.*



Make an upright or sacred cross, as placed above; put the excess of nines contained in the number whose root you are extracting in the place P; the excess of nines in the root found is to be placed in R, with an exponent equal to that of the number whose root you are extracting, and the excess of the nines contained in the sum of the figures which constitute your remainder in the place r. Then raise R to the power indicated by n (that is, square it for the square root, cube it for the cube root, &c.), and add r. If, now, the excess of nines in the sum of the figures of this result be equal to P, the work is *presumed to be right*; but, if not equal to P, the work is *certainly wrong*.

Before I close this paper, allow me to just remark that, in Mr. Young's mode of extracting the cube root, one step may be abbre-

viated and rendered less liable to error in the calculation, which, however, I should scarcely have been induced to notice, had it not been that, by my own practice and repeated observations upon my pupils' errors, I found the step was that in which mistakes were most frequently made. I have for some time used Mr. Young's work as my text-book in tuition, and am convinced that it is the *very best* we have on that subject which is accessible to the English student. That gentleman's mode of extracting the cube root is the one I have used ever since I became acquainted with it, and is the only one I teach to mere arithmetical students. It cannot, then, seem invidious or irrelevant to notice any improvement in the *rationale*, however slight or apparently unimportant that improvement may at first appear.

Instead of tripling the quotient figures to form the left-hand column (as one of the factors in the addend which converts the trial into the true divisor), in every successive operation after the first, let twice the last root figure be added to the preceding number in the left column. This gives the same result as the method of tripling the whole of the root already found—is far less trouble—is analogous to adding the last root figure in finding the trial divisor in the square root—and, above all, prevents the mistakes which are *more likely* to arise from multiplying than from adding, and those which are *very likely* to arise from the multiplicand and product standing so far apart as not to be seen without considerable and painful motion of the eye, and often even of the head, from the consequent distraction of the attention of the mind.

248	192	684321483279876(88122
16	19	512
	21184	172321
	64	169472
	23232	2849483
2641	26	2325841
2		
	2325841	523642279
	1	465802328
	2328483	57839951876
26432	528	46591863848
4		
	232901164	11248088028
	4	
	232954032	
264362	5287	
	23295931924	

PROOF. $3^3 \overset{6}{\underset{6}{+}} 6$, in which $3^3 = 3 \times 3 \times 3 = 0$; and, therefore, having its nines cast out, it becomes $0 \overset{6}{\underset{6}{+}} 6$, and therefore the work is presumed to be true.

NOTE.—It will always be advisable to verify immediately before you commence your abbreviations.

The improvement here proposed in Mr. Young's method is the same as a process for the like purpose in the method proposed by "Mutius," Mech. Mag. vol. ii. p. 160, and by Mr. Exley, in the Imperial Magazine, vol. i. 1819, col. 409. The rule given by "Mutius" is, indeed, iden-

tical with Mr. Exley's. It is worthy of remark how similar all the new methods are to each other, and when we have fairly attended to the investigations upon which they rest, we shall scarcely deem it probable that any material improvement will be made upon the methods already before your readers.

I recollect seeing, several years ago, in one of the early volumes of "The Leeds Correspondent," a new method of extracting the cube root, by the late Mr. Blamires, of Eccleshill; but as I have lost all distinct recollection of the process, which, however, I *then* thought a very short and a very good one, I shall feel obliged to any of your northern correspondents, who may have a copy f the work, to furnish me with it through your medium. An excellent method has also been given in the Imperial Encyclopædia, by Mr. Exley, of Bristol, which Mr. Horner has noticed at the end of his paper in the Philosophical Transactions, as nearly identical with his own. Mr. Exley has also published, in the Imperial Magazine, an improved method, differing a little from his former, and which is superior to every thing of the kind, except Mr. Young's, and scarcely surpassed even by that. T. S. D.

REVOLUTION OF COG-WHEELS.

Sir,—If a wheel of 127 cogs turns another wheel of 43 cogs, and they begin to move from any point of contact, the smaller will make 127 revolutions, and the larger 43 revolutions, before they come to the same point of contact a second time. This is true; but still a proof is wanting. Your Correspondent F* S*, in your 59th Number, p. 46, vol. III. says—"But if the larger will not divide by the smaller, nor both by the same number (as 43 and 127) the larger wheel revolves as often as the smaller has cogs, and *vice versa;* and this is all the proof he gives. I must humbly beg leave to differ with him, by considering this no proof at all.

The following demonstration will, I imagine, be found convincing, as well as satisfactory, to those who are acquainted with the revolution of wheels.

If 127 cogs drive 43 cogs, when the larger wheel has made one revolution, the smaller will have made $2\frac{41}{43}$ revolutions; because $127 \div 43 = 2\frac{41}{43}$. Now, $1 \times 43 = 43$, and $2\frac{41}{43} \times 43 = 127$; that is, the smaller wheel will make 127 revolutions, and the larger 43 revolutions, before they come in contact a second time. And if we take the wheels of 27 and 36 cogs: now $36 \div 27 = 1\frac{9}{27}$, or $1\frac{1}{3}$ (reducing the fraction $\frac{9}{27}$ to its least terms), then $1 \times 3 = 3$, and $1\frac{1}{3} \times 3 = 4$; that is, the wheel of 27 cogs makes four revolutions, and that of 36 cogs three revolutions, before they come in contact a second time.

Hence it appears to be a general rule or law, of two wheels stated to act as above, the number of revolutions made by each is inversely as the number of cogs in each wheel, when these numbers admit of no common measure.

I am yours, &c.

Joseph Hall.

Harpurley, Oct. 12, 1824.

PUMP IRONS.

Sir,—Three of the several plans of "X. Y. a Millwright," have at length made their appearance. The first I have been in the habit of using for more than twenty years—it is quite common. The second may answer the purpose very well where there is sufficient room; but, instead of the balance-weight, W, a much better plan is to have two working cylinders, and, consequently, two rods, to work up and down alternately: by this means a double quantity of water is raised in the same time, with about the same labour and in as little room.

If X. Y. will call at Messrs. Warners', No. 8, Crescent, Cripplegate, he may, with their leave, see several very excellent methods of working pumps, with one or more working cylinders; or, if more *convenient*, he may call on me, and I will show him drawings of them, and several others, admirably adapted for the

purpose, where the room and expense are not an object.

The third plan is the parallel motion invented by the late Mr. Watt: we have pump irons at Lincoln, now at work, on the same construction.

X. Y. states that he has fixed two pumps "precisely the same as those described by me," but whether before or subsequent to the publication of mine, in your Magazine, he has not mentioned.

X. Y. is certainly an odd fish—in one communication he condemns a thing, and in the next tells us that he has himself adopted it! X. Y. must not be offended at my disinclination to take his kind advice. *wild-goose chase*, from engine to engine, over the Fens of Lincolnshire, would, doubtless, be a good joke, but I feel no inclination for such a tour; neither do I much fancy calling at every door in Blackfriars'-road, to inquire for "X. Y. a Millwright;" but, as I expect to be in London some time in the ensuing spring, if X. Y. will favour me with his real address, I will certainly do myself the pleasure to call upon him.

I remain, Sir,

Yours, &c.

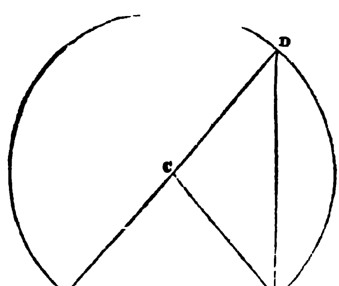
J. Bennett.

Lincoln, Nov. 8th, 1824.

MECHANICAL GEOMETRY.

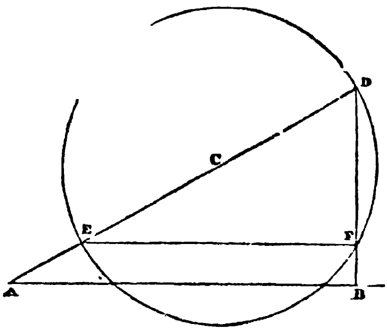
[CONTINUED.]

PROBLEM II.



From any point in a given line to erect a perpendicular, or, in other words, to draw a line that shall be square to a given line, from any point in that line.—Let AB be the given line, and B the point from which we wish to erect a line perpendicular or square to it. Draw any line, as BC, from the given point B, making any angle with AB; then, with the distance BC and centre C, describe a circle ABD, cutting AB in A; now, through A and C draw a line, till it cuts the circle in the point D; join DB; then is DB perpendicular or square to AB, and drawn from the point B, as was required; for, by Theorem III. Part 2, the angle ABD is in a semicircle, of which AD is the diameter; consequently the angle ABD is a right angle.

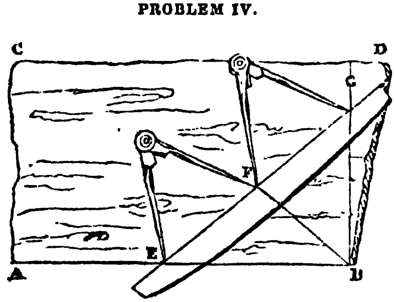
PROBLEM III.



From any point *above* or *below* a given line to draw another line which shall be perpendicular or square to it.—Let AB be a given line, and D a point above it; it is required to draw a line from the point D that shall be perpendicular or square to AB. From D draw any line, as DA, to cut AB; take any distance, as DC, on the line AD, and with that, as radius, describe a portion of a circle, as EFD; then from E draw EF parallel to AB (by any of the methods shown in Part I.), and from where EF cuts the circle in F, draw DFB, which will be square or perpendicular to AB, as was required; for the angle DFE is a right angle, by Theorem III. Part 2; and as EF is parallel to AB, the angle DBA is equal to the angle DFE (or a right angle), by Theorem III. Part 1.

Note.—If we had made CD equal to half AD, we should not have had to draw the parallel EF; for the figure to the last problem shows, that when CD is equal to CA, the circle will pass through B; but as we have not yet shown the method of bisecting or dividing a line into two equal parts, I have here given a method independent of it, which in many cases in real practice will be found useful to the workman. Again, if we had taken CD greater than the half cf A, the parallel EF would have been below AB; also, it will be remarked, if the given point D had been below the line AB, the operation would have been just the same, only the figure would have been reversed.

PROBLEM IV.



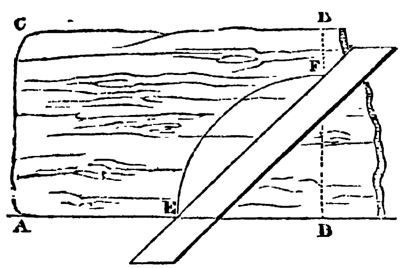
To cut the end of a plank, board, &c. square, by means of a *straight edge* and a pair of compasses only, and without drawing any lines or circles.—Let ABCD be the plank, and the end of which, BD, is required to be squared. Having made the edge AB quite straight, open the compasses at

any random distance, and place one leg at AB, and the other at any point, as F, in the direction BF; keep one leg at F, and turn the other round till it touches the edge AB at E; keep them firm, and apply the straight edge to EF, as the figure shows; keep the leg still at F, and turn them over into the position FG, G being close to the straight edge, and make a mark at G; now, if the straight edge is applied to G and B, and GB is drawn, it will be square to the edge AB.

Note.—This problem will be found not only very useful when a *square* is not at hand, but may be applied to advantage to set out any ground plan, such as the foundations of buildings, &c.; for, in the place of the compasses, we may employ a line of any determinate length, and then set out our walls at right angles to each other, by determining the points F and E as above, and extending a line in the direction EFG, and find the point G, which will be perpendicularly over the point B.

It is, perhaps, here necessary to observe, that the opening of the compasses ought not to exceed the half of the width of the board, otherwise the point G will be found beyond the board, and, of course, the problem cannot practically be resolved; and I would recommend the workman to open his compasses as near as may be the half of the width of the board, and let the direction of BF be as near as may be a mitre bevil, or 45 degrees; he will then have nearly as great an extent of compasses as he can have, and will find the distance of the points, E, F, and G, nearly as great as possible, and his solution will, of course, be the more accurate.

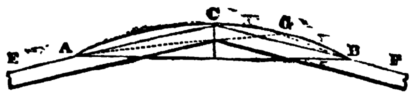
PROBLEM V.



By the help of a mitre square and a pair of compasses to erect a perpendicular from any point of a given line; or to square the end of a plank, &c. with the assistance of a pair of compasses and a mitre square.—Let ABCD be a board, and we wish to make the end DB square. Having shot the edge AB perfectly straight, assume any point, B, from which we are required to cut the end square; open the compasses any distance less than the width of the board, and draw the portion of a circle, as EF; apply the mitre square to the point E, as shown in the figure, and its edge EF will cut the circle in E and F. If now from the point F we draw FB, it will be square or perpendicular to AB; for, by the definition of a mitre, the angle FEB is equal to 45 degrees; and as FB is equal to EB, the angle EFB is also equal to 45 degrees by Theorem IV. Part 1: hence the two angles FEB and EFB, being together equal to 90 degrees, the other angle, EBF, is equal to 90 degrees, or square to the line AB, by Theorem [illegible] Part 1.

Note.—By this problem we may ascertain the accuracy of a *square* by means of the *mitre bevil*, or the truth of the *mitre bevil* by means of the *square*; and thus, when either of the instruments are not at hand, we may find a substitute for it in the other.

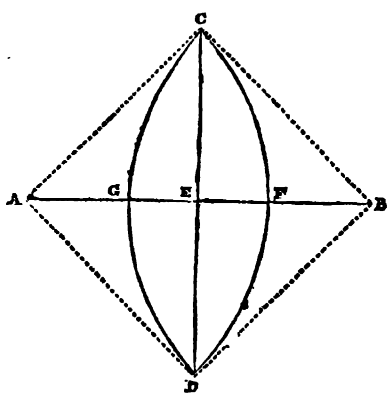
ROBLEM VI



Having given the chord of any arc and its versed sine, to describe the arc without knowing the centre of the circle; or, in the language of the mechanic, having given the opening of any arch, and the height to which it springs, to describe the arch without knowing its centre.—Let AB be the opening of any arch, and CD its spring, it is required to describe the arch ACB, without knowing its centre. Let CD be perpendicular to AB, and AD equal to DB; take two laths, EAC and FBC, each full as long as AB, and join them together firmly at C; then the angle ACB, which they form at C, is the angle in the segment ACB, which, according to Theorem I. Part 2, is always the same; let the point C be any where situate, suppose at G, then the angle AGB is equal to the angle ACB, or the angle the laths are fixed at; nothing, therefore, is necessary to describe the arch ACB, but to fix at A and B two pegs or nails, and fixing a pencil or tracer at C, let the angular point C of the laths CE and CF be moved from A to B, keeping the laths always pressed close to the pegs or nails at A and B, and the point C will describe the arch required.

Note.—The solution of this problem has already appeared in your Magazine, p. 361, vol. II.; but as no demonstration or reason was there given, and as it forms a very useful one to the workman, I have thought proper to repeat it, with such explanation as, I trust, will show the truth of this method, which is so very useful in drawing very flat arches.

PROBLEM VII.



To bisect a given line, or divide it into two equal parts.—Let the given line be AB; it is required to bisect it, or divide it into two equal parts. From A, with any opening of the compasses greater than the half of AB, describe the portion of a circle, as CFD; then, with the same opening, and making B the centre, describe the arc CGD, cutting the former arc in C and D; join the points C and D by the line CED; then is AE

equal to EB, and the line AB bisected as required: for join AC, CB, BD, and BA, and we shall have a parallelogram whose sides are all equal to each other, namely, the radius with which the arcs were described; for we have shown, in Theorem VIII. Part 1, that the diagonals (which are here AB and CD) bisect each other, and therefore AE is equal EB; moreover, CD is perpendicular to AB, for the triangles ACE and DCE are identical, or have their angles, as well as their sides, equal each to each; that is, AE is equal to BE, and AC equal to BC and CE, a common side to both triangles; therefore the angle AEC is equal to the angle BEC; and, by Theorem I. Part 1, the angle AEC, added to the angle BEC, is equal to 180 degrees, or two right angles; but as these angles are proved equal to each other, they must be each equal to 90 degrees, or the half of 180 degrees, or that CE is perpendicular to AB; and the line CE being continued to D, DE is also perpendicular to AB.

Note.—Hence, also, we have another method of drawing a line perpendicular to another from any given point; for if E is the given point, we need only set off EA equal to EB, and draw two arcs, crossing each other, as at C and D; then joining C and D, it is the perpendicular required through the given point E.

I am, Sir, &c.

G. A. S.

October 25, 1824.

MINUS.

SIR,—I am afraid that your Correspondents *Piger* and *Roderick* will both be disappointed, if they expect a familiar explanation why *minus* multiplied by *minus* produces *plus*. Having considered the subject since it was first introduced by *Piger*, I am inclined to offer a few remarks, which, although they may not prove quite satisfactory to them, may tend to place the subject in a new light, and perhaps be the means of calling forth clearer demonstrations from abler pens. I apprehend that the difficulty arises from viewing negative quantities *abstractedly*, and not as *parts* of a *whole*; for without this discrimination, fractions are liable to some apparent inconsistencies; for $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ and $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$, the products being diminished, instead of increased, by mutiplication: but if we suppose the integer to be an inch or a foot, the paradox is at once solved; for half a foot, or six inches, multiplied by 6 in. = 36 in., which is one quarter of a foot superficies, &c. Now, with regard to the multiplication of negative signs, if a quantity be said to be *minus*, it must be less than *something*, than some *absolute quantity*, for the sign − before it supposes it to be subtracted from a larger or affirmative quantity. Now $-a$, and $-b$, mean nothing of themselves, unconnected with some positive quantity; neither do the products arising from their multiplication, *simply* considered, mean any thing, but is merely the mechanical result of a fixed law, which assigns to them their office, in joint connexion with affirmative quantities, so as to produce a joint product; and *part* of that result dependent upon them in their joint capacity, they retain the power of producing, by the same universal law, in their separate and detached state; but it is *only a part*, and, without reference to the whole, has no determinate value. This may be more clearly seen by raising a square from the residual root $a-b$, making $a=10$, and $b=3$.

$$\begin{array}{rl} \text{Thus} & a-b \\ & a-b \\ \hline & aa-ab \\ & \quad -ab+bb \\ \hline & aa-2ab+bb. \end{array}$$

Then, proceeding in the same manner with the numbers representing these quantities, we shall have

$$\begin{array}{r} 10-3 \\ 10-3 \\ \hline 100-30 \\ -30+9 \\ \hline 100-60+9. \end{array}$$

Now, in this case, had $-3 \times -3 = -9$, instead of $+9$, the negative part of the product would have been -69, causing the result to be 31, which would have been inconsistent with

truth; for $10-3=7$, and $7\times7=49$ the true product: therefore, in order to counteract the ascendancy which the negative quantity would have thus derived, it was necessary that *minus*, multiplied by *minus*, should produce *plus*. This may, therefore, be considered a rule of *expediency* rather than of *reason*; whence proceeds the difficulty of explaining it on common principles.

Before I conclude, I would just notice an error committed by *Roderick*, where he makes the product of $a-b$ multiplied by $-b = ab+bb=48$; whereas it should be $-ab+bb=-16$.

I remain yours, &c.

LEGIS.

[Amicus, on the same subject, in our next."—ED.]

LONG AND SHORT HANDED SCREW-DRIVERS.

SIR,—Your Correspondent J. Y. p. 60, vol. III., has asked three questions, under the head, "*Difficulties to solve.*" "A.," in p. 77, has given his opinion on two of them, and professes to have solved one. Nichol Dixon, p. 95, objects to A.'s argument, and says, *rather unceremoniously*, that he has proved nothing. The perpendicularity of a long screw-driver (the cause of the increased power assigned by A.) may be too childish for such a giant in science as his adversary; but it would require more than declamation to convince me, or any one who has been in the habit of *using screw-drivers*, that A.'s reason has nothing to do with the question. That it is not the *only* reason, or even the *principal* one, I admit, but it certainly is *partly* the cause of the increased effect alluded to. The fact is, J. Y. was not sufficiently explicit in the first instance. If he were to ask me the power of a combination of levers of certain lengths, I should have no difficulty in answering him, consistently with the established laws of mechanics; but if he were to object to my reply, because the *bending of the levers* would diminish the power I had attributed to them, I should think this an *unfair* objection: because, in considering the properties of all machines, simple or compound, we are authorised to suppose that such machines *are perfect*; and, in every elementary treatise on mechanics, we are invariably told, in the outset, that all imperfections, in the nature of the bodies experimented on, are to be put out of the question, and our calculations are to be conducted precisely as if no such imperfections existed. In estimating the power of a number of cogged wheels, I should say, that they were effective in proportion to their size; and that their respective powers would be inversely as their velocities; and so on, without any reference to the *firmness of the wood* of which they happen to be composed. Now, a screw-driver may be called either a double lever or a single one; in the first case, the length of each lever will be equal to half the width of that part of the driver which fits into the head of the screw, or is equal to the radius of the circle formed by the revolution of the driver, the centre being the imaginary fulcrum. In the other case, the length of the lever will be equal to the whole width of that part of the driver which fits into the head of the screw; the power will, of course, be the same in each; for if we call it a double lever, each will have half the power of the single; and if we call it a single lever, it will have twice the power of each double one, the effect being always regulated by the distance between the acting power and the fulcrum. It seems to me most convenient to consider a screw-driver as consisting of two levers, because, in this case, the imaginary fulcrum in the centre is quite distinct from the acting and resisting parts of the instrument; while, in the case of a single lever, the situation of the fulcrum will correspond with the place where the acting power is applied, each extreme point of the driver forming in its turn the fulcrum to the acting power, and the acting power to the fulcrum. The resistance is also applied to the same place, and this is likely to cause confusion; I shall, therefore, suppose a screw-driver to consist of two levers of the third kind, where the power is between the weight and the

fulcrum; in such a case, we all know that power is lost as time is gained; that is, if A, of two pounds, will only raise B, of one pound, B will go twice as far as A, or the same distance in half the time. Now, as power is here *lost*, because the acting power travels *slower* than the resistance, so in all cases where the acting power travels *faster* than the resistance, power will be *gained* in the same proportion; and it is, of course, quite true *in practice*, that the elasticity of a long screw-driver will cause it to yield, or render (as a long lever will bend under a pressure that a short one would easily sustain), and thus, by giving way to the resistance, the lower end, or that which is applied to the screw, will hang back a little, and will not, therefore, go quite so far or so fast as the upper end of the driver, or the hand. If, then, we suppose that the upper part of the driver should in one revolution pass through three inches, while the lower part should only pass through two inches and a half, the power will be as much greater than it would be if the driver were non-elastic, as 3 is greater than 2½; or the power of the driver would be increased by its elasticity as 6 to 5. Now, a screw-driver, whose width at the lower end is 1 inch, consists of 2 inches, of half an inch each, having their fulcra just over the centre of the head of the screw, and as, in one revolution, each lever will pass through 1½ inch, the whole distance passed through by the acting power would be three inches; and if the driver were non-elastic, the power and resistance would be to each other inversely as their respective velocities; and as the screw, or resistance, would only move through a space equal to the distance between two of its spirals (and this, in one revolution, must be the case), if this distance be stated at one-eighth of an inch, then this power would travel three inches, or twenty-four times as far, in the same time as the resistance; the power would therefore be mechanically multiplied 24 times. But as the effects of the elasticity have been stated to be 1 in 6 in favour of the velocity of the power, it will be 1 in 6 in favour of its efficacy; and instead of the power being as 24 to 1, it will be nearly as 29 to 1. The first part of every mechanical operation is the most difficult to be performed, from causes which could easily be explained, but which would be out of place here. In driving a screw, the resistance is the greatest at first; and this very circumstance renders the elasticity of the driver more particularly serviceable at this moment than any other, for the increased resistance causes the screw to remain stationary for a short time after the handle has begun to move, and therefore is the means of increasing the power, by diminishing the velocity of the resistance; and this, too, at the very moment when such relief is most wanted, viz. the beginning of the operation. Elasticity, therefore, practically speaking, will be *one* cause of the increased power of a long screw-driver; though I take it to be unphilosophical, in estimating the power of a machine (*unless, for practical purposes, we are expressly desired so to do*), to consider any imperfections that may have arisen in the construction, or from the physical properties of the materials from which such machine may be composed. The smallness of the angle of deviation from a perpendicular being as the length of the driver, is also another cause (in *practice*); but this also arises from supposing the operation to be performed in an imperfect way; for if the man hold his hand steady (which in all operations we *suppose* him to do, unless expressly told to make allowance for the contrary), there would be no such angle of deviation at all.

I am, Sir, yours, &c.

D. H. In——y,

Portsmouth, Nov. 2, 1824.

Sir,—No one can have a fairer claim to give an opinion on any subject than he who is the subject of discussion; I therefore assert the right of replying to a query which was stated by one of your Correspondents, answered by another, and that answer ridiculed, in a somewhat flippant manner, by a third.

The acknowledged superiority of my long to my short-handed *driver*, I have experienced to be this: a very small error in the direction of the short-handed screw-driver, quickly occasions its edge to slip out of the groove or nick in the heads of my family. But it is obvious, that the greater the deviation of the screw-driver from the axis or direction of the screw, the greater must be its power, that power being proportionate to the sine of the angle of deviation; or, in other words, the distance between the end of the handle and the line of direction of the screw acts as a *lever*.

A short spud of a tool is sure of disfiguring my face, mutilating my cloven head, and of bearing me unequally against one side of the road, as well as of tearing and defacing the bed prepared for

I am, Sir,
Your humble servant,
SCREW.

November 3, 1824.

TAPPING NUTS.

SIR,—At page 445 of your valuable Magazine, T. C. D. gives a method of Tapping Nuts, which he considers is not generally known. I can assure him that he is mistaken, for I have seen it followed 25 years since in Scotland, and no one appeared in the least astonished. The astonishment of *his* workmen probably arose from the circumstance of his inserting a wedge, 5-8ths by 3-8ths, together with a tap 1-8th of an inch in diameter, into a nut only 2-8ths!

It is erroneous to assert that an excellent thread is formed by this method; for every one who knows any thing of screwing will perceive, that an iron wedge will carry off the sharp top of the thread. What I have seen used for the above purpose, was a slip of sheet brass, which will not materially injure the screw.

I am, Sir,
Your obedient servant,
D. SCREW.

Sheffield, October 9, 1824.

INQUIRY.

NO. 77.—RAYS OF THE SUN.

The rays of the sun, collected by a concave metallic or glass mirror, or transmitted through a convex lens, burn intensely at the focal point; the light of fire, collected by a metal mirror, has also a great heating power; but if collected by a glass mirror, or transmitted through a convex lens, no sensible heat can be perceived — Can any of your readers account for this seeming paradox?

I am, Sir,
Your obedient servant,
J. B.

ANSWER TO INQUIRY.

NO. 50.—OPTICS.

If a convex lens, of any focal length, *greater* than the focal length of the concave one, be placed with its focal point to correspond with the anterior focus of the concave lens, parallel rays, after passing through the two lenses, will again become parallel. This is, in fact, the form of the Galilean telescope, the concave lens being applied to the eye.

I am, Sir,
Your obedient servant,
J. B.

CORRESPONDENCE.

We shall be glad to hear again from Nimrod.

Communications received from—J. Phelps—Lewis Moore—W. Y.—Jack Robinson—A Young Engineer—N. Wales—R. B. P.—C. D. W + 8—W. C.—Alfred Hall—P. G. D.—E. J. Mitchel—A Mechanic — Nauticus — A Constant Reader—W. J. C.—A. F. S.—R. W. D.—W. C., &c.

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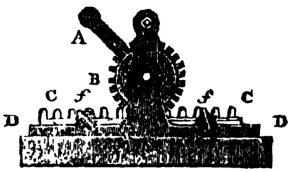
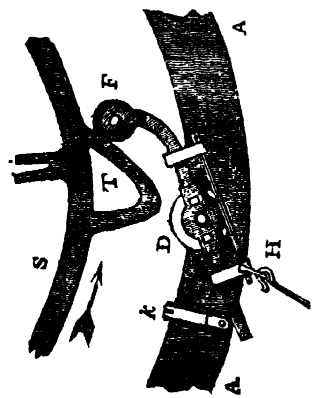
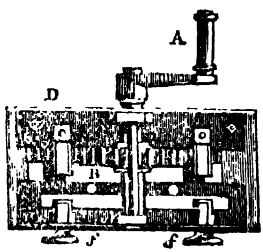
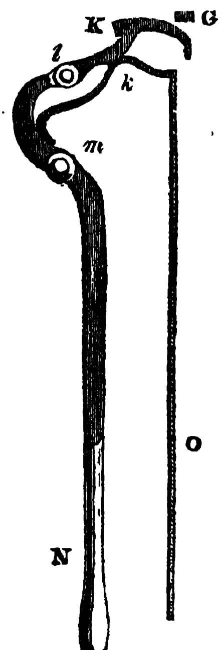
PROCESS OF COINING AT THE ROYAL MINT.

(Continued from our last Number.)









PROCESS OF COINING AT THE ROYAL MINT.

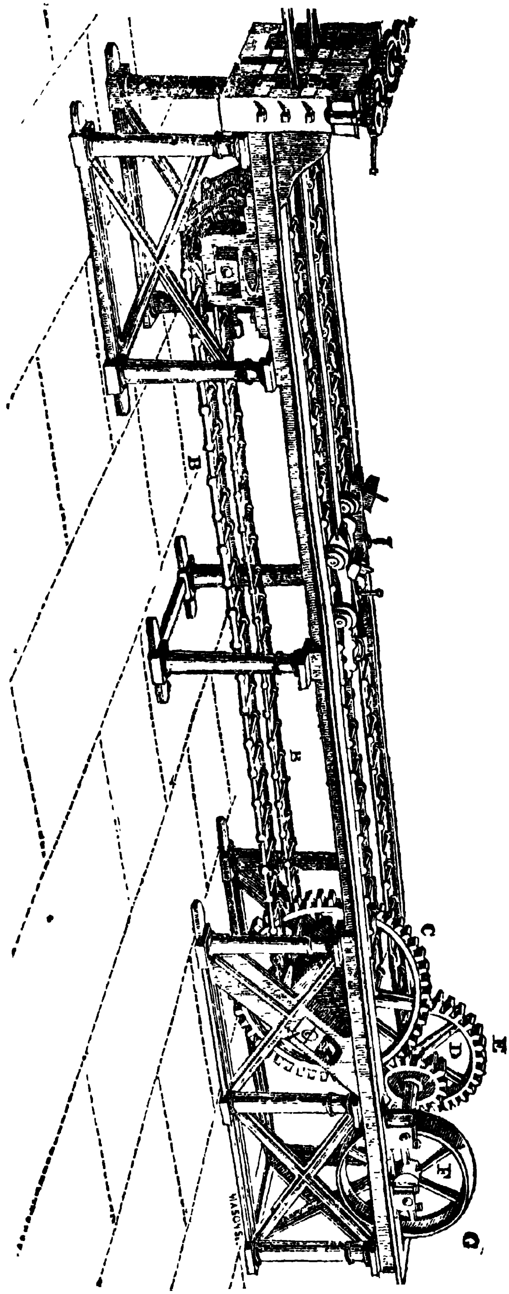
The blanks, after being cut out by Bolton's cutting-out press, described vol. I. p. 249, are carried to the sizing-room, where each individual piece is adjusted to its standard weight. The light pieces are selected for remelting, and the heavy ones, if not considerably beyond weight, are reduced to their standard weight by rasping their surfaces with a coarse rasp or file. The superior accuracy of Mr. Barton's beautiful machine (described in our last Number) has considerably abridged the labour of this inelegant and unmechanical process.

The pieces thus adjusted are in a state of great hardness, from compression by the rolling and drawing processes, and by which, in fact, their latent heat has been squeezed out. They attain their softness again by being heated to a cherry red heat in a reverberatory furnace; after which they are boiled in very weak sulphuric acid, which makes them very clean, and of a very white colour. When dried, either in warm sawdust, or over a very slow fire, they are in a state for the two next processes, which are the milling, and the coining or stamping.

The operation of milling is to be performed round the edge, to prevent their being clipped or filed, which was a fraud commonly practised upon the ancient money made before the introduction of milling or lettering round the edge. The construction of the milling machine will be easily understood, from the inspection of the 1st and 2nd figures given with the present Number, being an elevation and plan of the same. The parts which operate upon the piece of money, consist of two steel bars or rulers, DD, the adjacent edges of which are cut or fluted; the lower bar, seen in the plan No. 2, is immoveable, being fastened down by two clamps to a cast iron plate, D, forming the base of the whole machine; the upper bar is prevented from rising by the two vertical pieces, but has the liberty of moving backwards and forwards in the direction of its length, and is guided in such motion by laying half its thickness in a groove formed in the plate D. A rack, CC, fig. 1, is fixed to the moving ruler, which engages in the teeth of the wheel B, mounted on an axis lying across at right angles to the ruler, and supported at its ends by two standards, rising up from the plate D. On one end of the axis a handle is fixed for giving motion to the machine. Two blanks are put into the machine at the same time, as seen in the second figure, and the lower ruler can be made to approach nearer to, or recede farther from, the upper ruler, by the two screws, *ff*, to take in a different-sized piece between them The operation of the machine is very simple Two blanks being placed between the edges of the rulers, the handle, A, is turned round half a turn, which moves the upper ruler endways, sufficient to mark the blank all round the edge. The two milled pieces are then taken out, and two other blanks are placed between the rulers; the handle, A, being turned half round in an opposite direction, carries the upper ruler back again to the position in which it first stood; thus two more blanks are milled, and so on. The machine is placed upon a strong wooden bench, to raise it to a convenient height for the man who turns the handle; the blanks are placed in the machine by a boy, near to that where the handle is

The third and fourth figures prefixed are further illustrations of Bolton's cutting out press (described p. 249, vol. I.) Fig. 3 shows the manner of the horizontal wheel acting on the roller, F. (See the figure, p. 249.) It represents a horizontal plan of the upper part of the axis S, fig. 3, is part of the rim of the large wheel, and T, one of the projecting cogs, which, when the wheel turns in the direction of the arrow, will take the roller F, at the end of the lever FD, and turn the lever round in that direction which will wind up the screw, and raise the punch out of the die This action also draws a rod, H, which is connected with the lever by a joint; the other end is connected with a bended lever, from the other end of which a rod descends, and has a piston fixed to it. Figure 4 is the catch. At K it is moveable on a joint E, and is thrown upward by a spring, *k*. To this spring a cord, O, is fastened, and the lower end of the cord has a treadle fastened to it.

The Engraving on the following page is the perspective view, promised in our last, of Barton's Rolling Machine.


B
B
C
D
E
F
G

BREAD AND POTATOES.

SIR,—I shall feel greatly obliged to any of your Correspondents who will furnish me, through your Magazine, with a description of the mill used for grinding potatoes for the baker, or who will inform me where I can procure it. I am fully convinced, by trial, that potatoes tend to make bread lighter than wheat-flour alone can do, and chemical analysis shows bread so made to be wholesome and nutritious. It will, perhaps, excite surprise that I should recommend a practice for which bakers are generally condemned and held up as a body of men who pick our pockets and feed us with poison; but, *if* they confined the mysterious part of their science to the introduction of potatoes, we need be under no apprehension about the latter, though there might be some difficulty in acquitting them of the former, because bread is made at less expense with an admixture of potatoes than with flour alone; but who would deal with the baker who should advertise cheap bread, composed of flour and potatoes?—Prejudice, invincible prejudice, would be his ruin. The people must have pure wheaten bread, and so white to boot, that it is impossible it *can* be pure. The baker is thus compelled, *nolens volens*, to have recourse to deception, and to plunge his thumbs into as strange a composition of heterogeneous ingredients as that into which the pilot's thumb was introduced by the weird sisters of Shakspeare, and with a somewhat similar effect—a train of ghostly loaves are *raised*, and the customers are satisfied.

I wish to take this opportunity of correcting a misstatement in "Cobbett's Cottage Economy," respecting the comparative merits of wheat and potatoes, to the latter of which he appears to entertain as *rooted* an antipathy as if all *pommes de terre* were *grands hommes de terre*. Let him rail against *potentates* if he will, but let him not send forth such a libel against *potatoes* as to assert, as "an established fact," that they contain only *one tenth* of their weight of nutritive matter; whereas it has been ascertained, by Sir H. Davy, Gay Lussac, and other chemists, that *one quarter* of their weight is nutritive. The quantity of nutritive matter, thus calculated, in an acre of potatoes, so far from being, as Cobbett attempts to prove, much less than that in an acre of wheat, is more than double. I will meet him on his own *ground*, an acre of which, he states, will produce 32 bushels of wheat, or 300 bushels of potatoes; now, 32 bushels of wheat weigh 1920 pounds, and 300 bushels of potatoes weigh 16,800 pounds, one quarter of which, viz. 4200 pounds is nutritive, making a balance of 2280 pounds in favour of potatoes. The parings are not deducted, but neither is the bran, the weight of which is ten pounds in every sixty, or in every bushel, which will, at least, equal the loss in paring the potatoes.

I am, Sir,
Your humble servant,
PHILO-MURPHY.

MINUS.

SIR,—In your 60th Number you have a communication from a Correspondent "Piger," proposing a difficulty concerning the multiplication of quantities affected by the algebraic sign *Minus*. I have a fellow-feeling for "Piger," well recollecting to have been greatly annoyed by the same apparent paradox which disturbs him. I almost despair of being able to make the matter clear to him, but I will try. Suppose a man, in keeping his accounts, had different pages in his book, for debts which he owes, of different values; debts of 1000, debts of 500, debts of 100, &c. The pages appropriated for these might be headed, respectively, $-1000, -500, -100$. Under any one of these heads, $a\,3$ would signify that three such debts existed; $a\,0$, that there was no such debt existing; but $a - 3$ would show not only that no such debt existed, but that the account of debts of that value was three terms below nothing; in other words, that there were three sums of that value due to the account, and the page would exhibit (*in terms of* a debt of a certain value) an actual credit of three times the heading of the page.

I subjoin the following demonstration, which is a note of the editor of the translation of Euler.

"If we consider the product arising from the multiplication of the two quantities, $a - b$ and $c - d$, we know that it is less than that of $\overline{a-b} \times c$, or of $ac - bc$: in short, from this product, we must subtract that of $\overline{a-b} \times d$; but the product $\overline{a-b} \times \overline{c-d}$ becomes $ac - bc - ad$, to which is to be annexed the product of $-b \times -d$, and the question is only which sign we must employ for this purpose, whether $+$ or $-$? Now we have seen that from the product $ac - bc$ we must subtract the product of $\overline{a-b} \times d$, that is, we must subtract a quantity less than ad; we have, therefore, subtracted already too much by the quantity bd: this product must therefore be added, that is, it must have the sign $+$ prefixed; hence we see that $-b \times -d$ gives $+bd$ for a product, or $-$ *minus* multiplied by $(-)$ minus gives $(+)$ plus."—*Note, p. 12, English translation of Euler.*

If once you consider a *minus* quantity as *a debt*, you may deal with it as with any other article whatever; whether a man is minus nine pounds, or minus three debts of three pounds, is equally easy to be understood; but, in the first case, he is nine pounds out of pocket, in the second he is nine pounds in pocket, and $-3 \times -3 = +9$, or $-a \times -b = +ab$.

I should be very glad to hear that my view of the subject has given Piger any satisfaction.

I am, Sir,
Your humble servant,
B. Q. T

VALLANCE'S CROSS-CUTTING SAW.

SIR,—In answer to our friend Nauticus (p. 39, vol. II.), who seems not to comprehend how my Cross-cutting Saw is to be used horizontally, wrought by a pendulum twelve feet long, I have to inform him, that the length of the pendulum is no hindrance to cut trees close by the ground. The shaft (see the figure, p. 49, vol. II.) which communicates the motion from the pendulum to the saw, can be placed either higher or lower, so as to give the proper motion to the saw; and a tree may be thus cut nearer the ground than it can be done with the common cross-cut saw. It is not intended that the frame should prevent the saw from cutting the tree, until it comes to the rod that the saw slides on (F), when the frame is fixed to the other side of the tree, and the saw wrought till it meets the first cut.

I am, Sir,
Your obedient servant,
DIXON VALLANCE, Mechanic

GENIUS OF INVENTION.

"If you would have a man display all the native resources of his mind," says an eloquent writer in the Edinburgh Review—"if you would bring all his faculties and powers into full activity, you must deprive him of all adventitious assistance, and render him exclusively the architect of his own fortune. It is not to those who have been born with a competency, but to those who have been bred in the hardy school of poverty, and who have raised themselves to an eminence that mankind are indebted for almost all those improvements and inventions which have so greatly extended the empire of mind and matter, and made such vast additions to the sum of human happiness. Notwithstanding of its being the great avenue to power and emolument, it has been frequently remarked, that there is scarcely an instance of an individual possessed of 500*l.* per annum of patrimony making any figure at the English bar! The same observation might be extended to most other professions. Necessity is the grand goader, and therefore *poverty* is a part of the universal system."

Why, then, should a man be accused of being radical or jacobinical, *merely* for saying, "I know no other claims to my respect than those founded on useful talent, coupled with industrious and honest application." What are hereditary honours and riches, in comparison with the meritorious application of talent? Have not both the first been transferred to the owner by *another*, in whom alone *all* the claim centres and remains of *all* the honour, or perhaps all the *disgrace*, of having acquired them? How widely different is not the case with the man of talent? To HIM belongs *all* the honour *exclusively*: HE is indebted to

no one but *himself*. What an enviable badge! What are hereditary honours compared to it? The only transfer that, in his case, takes place, consists in *his* transferring, not to his heirs only, as in the above is the case, but to the community, nay, to posterity, those immense, those lasting and incalculable benefits, *which talent* ALONE *can confer*.

The useful inventor takes a mite out of the millions HE confers; THIS *I call princely liberality;* whilst the nobles and the great, who claim on hereditary grounds, take the millions, too often without even returning the mites to those who have contributed the millions. By purse-proud fools, and such other undeserving beings—by such real *paupers* in talent and industry, the useful man of talent is often called a schemer—a needy adventurer—a beggar—or a member of "the swinish multitude!" And why?—Merely because HE is not living on the *bounty* of his ancestors, or, as a sinecurist, on the *charity* of the community. Any idiot can consume the earnings of others which are *given* to him; and if poverty is a disgrace, it can only be that poverty which indolence cherishes, or extravagance creates; including the poverty of mind so common with the self-sufficient man of purse, who, although possessed of the opportunity, seconded by splendid means for cultivating his mind, and applying talent so engendered, in the innate poverty of his narrow mind, fails to do so; whilst the man deficient of property, energetically, and under every galling disadvantage, breaks down the greatest of all obstacles, not only to live truly independent, but even *to give fortunes to others*. HE wants no one to confirm his nobility, much less to confer it: HE ennobles himself, for his heraldic vouchers of true nobility are to be read in every invention or improvement by which the community is benefited—monuments more convincing and more lasting than those *explored* by the Herald Office; and as to *his* being a *pauper*, *is he not rather* a TREASURY, *upon which all the world draws, without its ever stopping payment*? Hereditary rank and wealth sink into insignificance, compared with such distinctions.

I am, Sir,
Your obedient servant,
JUNIUS ANAXARCHUS.

LONDON IMPROVEMENTS.

SIR,—I beg to hand you for insertion a continuation of the "Improvements of London," proposed ninety years ago, as desired by T. N.; who observed, "It will show how far it has been acted on in our day." In the cases which I now submit, he will see that it has been done exactly as proposed.

"The *Custom House* is a place which, by its use and situation, can hardly fail of being visited by strangers. I could have wished, therefore, on that account, and likewise because we are more famous than our neighbours for naval affairs, that this building had been more costly and magnificent: it would make a seasonable impression on foreigners, even at their landing, of the majesty and wealth of the British nation; to which, let me add, its situation by the water-side gives it a still *juster* claim to grandeur and decoration, and it is a pity so public a building should want what is so remarkably *mist*.

"The *India House* is certainly unworthy of the Company's figure in the *trading* world, and would better suit with the common life of a single Director, than the pomp and state of the whole body. The fabric, indeed, is built in taste, but there is not enough of it; and if they had *thought of adding a portico in the middle*, it would have looked more like a finished building than it does now.

"*St. Martin's Church.*—I could wish, too, that *a view was opened from* the Mews to St. Martin's Church. I don't know any one of the modern buildings about town *which better deserves such an advantage*: the portico is at once elegant and august, and the steeple above it ought to be considered as one of the most tolerable about town. If the steps arising from the street to the front could have been made regular, and on a

line from end to end, it would have given it a very considerable grace."

If T. N. will go to the three places above alluded to, he will see how the proposed improvements have been since executed, or are at the present moment executing.

I am, Sir, &c.

JULIUS.

October 28, 1824.

CALCULATING PRICE OF TIMBER.

SIR,—A more concise mode of reckoning the value of Deals, than that given by "A Timber Merchant's Foreman," in your last, I think is the following:—Consider every penny in the value of a deal 10s then half the price in pence will be the value of a long hundred of deals in pounds.

Deals at 7*s*. 4*d*. each = 88*d*. ÷ 2 = 44*l*. per hundred.
Deals at 8*s*. 1*d*. each = 97*d*. ÷ 2 = 48*l*. 10*s*. ditto.
Deals at 7*s*. 9*d*. each = 93*d*. ÷ 2 = 46*l*. 10*s*. ditto.

And, on the contrary, double the price in pounds will give the value of a deal in pence, thus:—

Deals at 46*l*. 10*s*. per hundred, × 2 = 93*d*. = 7*s*. 9*d*.
Deals at 48*l*. 10*s*. per hundred, × 2 = 97*d*. = 8*s*. 1*d*.
Deals at 44*l*. per hundred, × 2 = 88*d*. = 7*s*. 4*d*.

The reason of this is very clear: 120*d*. is 10*s*.; therefore, if a deal cost 1*d*. it is evident 120 would cost 10*s*. Or, if your Correspondent had confined himself to multiplying the price in shillings by six only, it would produce the same result without the aliquot parts of a pound, by considering the shillings pounds, and adding thereto the value of the pence in the same denomination, thus:—Deals at 7*s*. 4*d*. each, × 6 = 24*d*. = 2 + 12 = 44*l*. as before. The reverse: divide the pounds per hundred by six, will give the value of one in shillings and pence. Deals at 46*l*. 10*s*. per hundred ÷ 6 = 7*s*. 9*d*. or 46*s*. 6*d*. ÷ 6 = 7*s*. 9*d*.

I am, Sir, &c.

Nov. 14th. J. S.

DIURNAL MOTIONS OF THE BAROMETER.

SIR,—The Monthly Magazine for the 1st of January, 1806, came into my hands, by accident, a few days subsequent to the appearance of my communication in the 42d Number, vol. II., of your Magazine, wherein I perceived accounts of the Diurnal Variations of the Barometer, extracted from papers submitted to the Royal Society. I was somewhat surprised at this, as I had failed in obtaining any information on the subject, though, as I stated on a former occasion, I had, in anticipation, made several inquiries after it.

These papers are as confirmatory of the hypothesis I have advanced, as the nature of the instruments, and the times and places of observation, were capable of rendering them. There are a variety of circumstances, general as well as local, to be taken into account in making observations on this phenomenon, even with the instruments best adapted for the purpose, which cannot fail to have considerable influence in rendering such small effects almost imperceptible, and, with a common barometer, totally out of the reach of the most acute observer.

Enclosed, you have the extracts alluded to, which you will oblige me by giving a place in your pages.

I am, Sir, &c.

WM. GILMAN.

Royal Society, London, Jan. 1, 1806.

Henry Cavendish, Esq. a member of this learned body, has submitted to the Society an "Abstract of Observations on a Diurnal Variation of the Barometer between the Tropics," by J. Horsburgh, Esq. This Gentleman, in his voyage to the East Indies, employed two marine barometers and thermometers, which were exposed to a free current of air in a cabin, where the basons of the barometers were thirteen feet above the level of the sea. The hours for observation were at noon, four and twelve in the afternoon, and at four and seven in the

morning; because the mercury in the barometer had at these times been proved to be regularly stationary between the tropics. It was found that, in settled weather, in the Indian Seas, from eight A. M. to noon, the mercury was not only stationary, but, at the point of the greatest elevation, afternoon, it began to fall, and continued falling till four o'clock, when it was at the lowest point of depression. From four to five the mercury rose, and continued rising till about nine P. M., at which time it had gained its highest elevation, and continued stationary till midnight; it then fell till four o'clock, when it was as low as it had been in the preceding afternoon; from this time it rose till seven or eight, and continued stationary till noon.

Thus was the mercury subject to a regular elevation and depression twice in twenty-four hours, in settled weather, and the lowest station was about four o'clock in the morning and evening; from these times till eight in the morning and nine in the evening, it had a regular tendency to rise, when it was stationary till noon and midnight.

In unsettled and blowing weather, especially at Bombay, during the rains, the regular ebbings and flowings of the mercury could not be perceived. The atmosphere seems to produce a different effect on the barometer at sea from what it does on shore, as the following abstract will show:—

From leaving the Land's-End, the mercury was fluctuating and irregular till they came to lat. 26. N. long. 20 W.; it then uniformly performed two elevations and two depressions every twenty-four hours. From lat. 26. N. to 10. N. the difference of high and low stations of mercury in the barometers was not so great as it was from lat. 10. N. to 25. S. Within these last-mentioned limits, the difference of high and low stations of the mercury in the barometers was from 500 to 900 parts of an inch, both in the daily and nightly motions.

In lat. 28. S. it was again fluctuating, and continued so till 27. S, when it became subject to the equatropical motions, and continued so till the ship reached Bombay, August 6, 1802. On shore, for the first six days, the mercury had a small tendency towards performing these motions; but from the 12th to the 22d of August, they could not be perceived.

On leaving the harbour, they were again very perceptible, and continued so, with great uniformity, till the arrival of the ship in Canton river, October 4. It then became nearly stationary, and, on shore at Canton, the barometer had little tendency to the equatropical motions through the months of October and November. Observations similar to the foregoing were made from this time till the arrival of the ship in Margate Roads, which went to the confirmation and establishment of the same facts.

Mr. Professor Playfair has presented to this Society, "A Comparison of some Observations on the Diurnal Variations of the Barometer, made by M. Lamanon, in Perouse's Voyage round the World, with those made at Calcutta, by Dr. Balfour."

The agreement between these is remarkable. Dr. Balfour found, during the whole lunation, in which he observed the barometer from half-hour to half-hour, that the mercury constantly fell from ten at night to six in the morning, and from six to ten in the morning it rose; from ten in the morning to six, it fell again, and, lastly, rose from six to ten at night. The greatest height is therefore at ten at night and ten in the morning, and the least at six at night and six in the morning.

The only difference between this and the result of M. Lamanon's observations is, that, according to the latter, the minimum is stated to have happened about four instead of six.

According to Dr. Balfour, the variations of the barometer are connected with the reciprocations of the sea and land winds during the day and night. But the probability of this supposition is destroyed by the observations of the French navigators. These observations were made too far out at sea to leave room for supposing, that the land winds had any influence in the phenomena to which they refer.

It is, at the same time, doubtful whether those phenomena can be ascribed to the atmospherical tides produced by the sun and moon, as the ebbing and flowing of the mercury in the barometer appears to have no dependence on the position of these luminaries relatively to one another, but happens, it should seem, constantly at the same hour, in all aspects of the moon, and all seasons of the year.

BROWN'S PNEUMATIC ENGINE.

SIR,—Your Correspondent J. Y., in p. 31, of vol. III., says—"Mr. Brown's contrivance is not new." I shall not at present inquire into the truth of this statement, but I will venture to affirm, that J. Y., like the *ingenious men* to whom he alludes, is asserting that which is erroneous. The machine which J. Y. saw in full action, is nothing more than a model of the air engine invented by the Rev. Mr. Sterling, and for which he obtained a patent. The principle upon which this engine acts, is by the alternate expansion and con-

densation of the same air, by means of two cylinders joined together by a small tube, through which the air passes from one cylinder to the other.

I am, Sir, &c.

D. SCREW.

SIR,—Observing, some time ago, a description of an engine called *Mr. Brown's* Gas Engine, which was said to be a grand discovery, but not having heard any thing very lately about it, I should be much obliged if any of your Correspondents can inform me whether it has been applied to any purpose where a comparison could be made with steam engines of the present day?

I am, Sir,

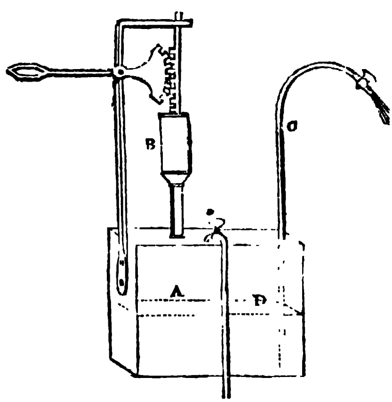
Your obedient servant,

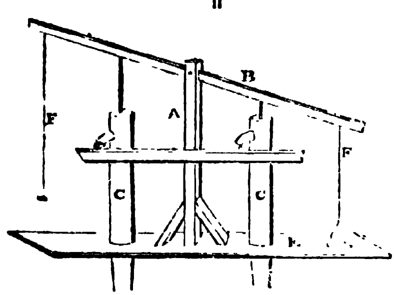
A. F. S.

Commercial Road.

ANSWER TO INQUIRY.

NO. 57.—RAISING WATER.





SIR,—I send you a Plan for Raising Water, which I think will answer the inquiry of your correspondent J.B.B. p. 368, vol. II.

A is a strong cistern, B an air-pump for forcing air into A; C is a pipe soldered into A, reaching within an inch of the bottom. D is a pipe which supplies A. When it is about three parts full, it must be turned off at *c*. The reservoir is pumped as full of air as possible, by means of

the air-pump, B; the water will then be forced through C as high as wanted

I am, Sir,
Respectfully yours,
P. VANRYDE.

[We have received several other answers to this inquiry, of which J. B. B. may have inspection on making his wishes known to us. The above we have preferred for its simplicity.—ED.]

I have also sent you a plan of two Pumps, which I have frequently seen working in Holland.

A is an upright piece fixed in the platform E; B, a cross piece, working in a groove made in A, and attached to the suckers of the pumps, C, which are worked by two lines, *f*; D, a trough to carry off the water. Thus two men can raise an immense quantity of water in a day, as there is a constant stream from one or other.

P. V.

PERKINS'S STEAM ENGINE.

The claim of Mr. Perkins to the invention of his new Steam Engine is contested by a Mr. James Scott, of Rhode Island.

"The principle (he says) to which I alluded is capable of an infinite variety in its application, and embraces every possible construction in which the steam, condensed both by pressure and reduction of temperature, returns to the place of its generation to be used again—such is the broad ground of my claim. In my engine the working cylinder is within the boiler, and entirely surrounded with the fluid, and the whole is enclosed in a furnace of sheet iron. The steam, after giving motion to the piston, is forced by its reaction into another vessel, which I call a cooler; and from this last the boiler is resupplied by means of a small pump, and is kept always full.

"As none of the fluid is lost except from the unavoidable imperfection of the apparatus, I further proposed the use of æther or spirits instead of water. These fluids exert a given force with comparatively small expense of heat—an object of prime importance; for, in proportion as the requisite heat is lessened, the weight and size of the boiler and furnace may be diminished, as well as the cost, weight, and storage of fuel."

MINUS.

SIR,—I have lately had a discussion with a friend of mine, who has the same faith as your correspondent "Piger," respecting the existence of negative quantities, but who, like him, was unable to explain it to his own satisfaction. I rather think there are many others who entertain the same sort of faith in this matter, which, indeed, is not surprising, when such learned mathematicians as Euler, Maclaurin, and Monsieur Clairaut, have put forth the doctrine, although they have not reasoned sufficiently clear on the subject to bring conviction to our understanding. The existence of negative quantities has, therefore, been taken on trust, and I see no impropriety in acknowledging myself a dissenter from this *universally established truth*, as others, whose opinions are worthy of respect, have set the same example. I would refer your correspondents, "Piger" and "Roderick," to William Frend's Treatise on the Principles of Algebra, published in 1796, in which they will find the existence of negative quantities altogether denied. After explaining the meaning of the algebraic characters, Mr. Frend proceeds to state that—"In writing down numbers, with their relations, in algebra, it is improper to begin with any of the marks but those of numbers. The numbers must be first written down, to or from which another is to be added or taken away, into or by which another is to be multiplied or divided. The same is also obviously necessary for the marks of equality or difference. It is improper to unite thus: $-a+b\times c=\frac{d}{e}$; it should be, $b\times c-a=\frac{d}{e}$. Again, to write thus, $b\times c-a=-f$, is not only improper, but absurd, as will be seen by attempting to read it. From b into c take a: the remainder is equal to some number which we will call m: but the mark $-$ before f denotes that it is to be taken away

from some number which is not written down, and we cannot make any sense of the expression $-f$."

Minus multiplied by minus is said to produce plus in compound quantities, merely for convenience in shortening the process, as Friend very clearly explains by changing the signs and proceeding by addition, although, in fact, it does not of itself produce that result.

$$
\begin{array}{rllllll}
\text{Multiply} & 2a & +\,3b & -\,4c & & & \\
\text{into} & a & -\,b & -\,c & & & \\
\hline
\text{from a product} & 2a^2 & +\,3ab & -\,4ac & & & \\
\text{take } b\text{'s} & & 2ab & & +\,3b^2 & -\,4bc & \\
\hline
\text{from } a - b\text{'s product} & 2a^2 & +\,ab & -\,4ac & -\,3b^2 & +\,4bc & \\
\text{take } c\text{'s product} & & & 2ac & & +\,3bc & -\,4c^2 \\
\hline
\text{whole product} & 2a^2 & +\,ab & -\,6ac & -\,3b^2 & +\,bc & +\,4c^2 \\
\hline
\end{array}
$$

The shorter way, by changing the mark, and adding the several products.

$$
\begin{array}{rllllll}
\text{Multiply} & 2a & +\,3b & -\,4c & & & \\
\text{into} & a & -\,b & -\,c & & & \\
\hline
a\text{'s product} & 2a^2 & +\,3ab & -\,4ac & & & \\
b\text{'s prod. with } m \text{ changed} & & -\,2ab & & -\,3b^2 & +\,4bc & \\
c\text{'s prod. with } m \text{ changed} & & & -\,2ac & & -\,3bc & +\,4c^2 \\
\hline
 & 2a^2 & +\,ab & -\,6ac & -\,3b^2 & +\,bc & +\,4c^2 \\
\hline
\end{array}
$$

Those who endeavour to support his theory define a negative quantity to be that which is to be substracted, yet we cannot understand how a quantity is to be subtracted without an affirmative quantity preceding it. It appears, therefore, to me, to be a part of a compound quantity only, and that, of itself, it cannot possibly exist.

I remain, Sir,

Your obedient servant,

AMICUS.

PRACTICAL GEOMETRY; BY T. S. DAVIES.*

No. II.

THE CONE AND ITS SECTIONS.

It will be needless to tell my readers what a cone is, but still it may be necessary to state the conditions that determine a cone to be of any particular character, as well as to define a few of its parts.

When the base of a cone is a circle, and the vertex or summit at equal distances from any three points in that circular base, the solid is said to be a right cone, and of such a one we will suppose ADE (fig. 1) to be a perspective representation, the dotted lines in the figure being intercepted from the sight by the parts standing before them. If a sector of paper (as fig. 2) be wound round till the edges, AB, AC, coincide, the surface will be that of a right cone.

In the present paper the problems will refer to a right cone, which is so cut that its base is circular. Such a cone may be also cut in different directions, as in the following

DEFINITIONS.

DEF. 1.—When the cutting plane passes through the vertex, A, as in fig. 3, the section will be a *triangle*, AFG.

DEF. 2.—When the cutting plane is parallel to the base, or such that any three of the points in which it cuts the conical surface are equidistant from the vertex, the section is a *circle*, a perspective view of which is seen in fig. 4.

DEF. 3.—When the section is oblique to the circle, but such as by being prolonged it would cut the opposite side, or the prolongation of the opposite side, the section, is an *ellipse*, as in fig. 5.

DEF. 4.—If the section be such that a straight line, KH, drawn along the middle of it, shall be parallel to

* The Diagrams illustrative of this article will be given, with the continuation, in our next.—EDIT.

the side, AD, the section is called a *parabola*, fig. 6.

DEF. 5.—If the section be such that a line, KH, drawn along the middle of it, converges towards the prolongation of the side above the vertex of the cone, the section is called an *hyperbola*, fig. 7.

DEF. 6.—If another cone be found by prolonging the boundaries of the original cone above the vertex, the cones are called *opposite* or *vertical cones*.

DEF. 7.—If the plane which makes the hyperbolic section be also produced till it cuts the opposite cone, the section is called an opposite hyperbola.

I must here re-urge my former advice, that my readers will procure models, either of wood or clay, upon which to study these definitions, and the course of problems in this and succeeding papers on this important branch of Solid Geometry.

PROBLEM I.

Having given a portion of a cone, to determine the nature of the section by which it is cut off.

Draw any two lines parallel to each other, EF, HG, in figures 9,* 10, 11, and bisect them in K, L. Take any two other lines, as BC, DE, also parallel to each other, and bisect them in M and N. Draw KL and MN to determine the section.

1. If the lines KL, MN, be parallel, the section is a parabola.

2. If they tend to meet on the same side of the curve towards which the shorter of each pair of parallel lines lies, the curve is an hyperbola.

3. If they tend to meet on the side of the longer of each pair of parallel lines, the section is an ellipse.

DEF. 8.—The point O, in which the lines MN, KL, (in figs. 9 and 11) intersect, is called the *centre* of the ellipse or hyperbola.

DEF. 9.—That part of the conic section in which the cutting plane first comes in contact, is called the *vertex* of the section, as A in figs. 9, 10, 11; or K in figs. 1, 4, 5, 6, 7, 8.

PROBLEM II.

To find the vertex of a conic section situated on a plane.

CASE. 1.—In case of the ellipse and hyperbola (figs. 9 and 11), with centre O and any convenient radius, describe circles cutting the curve in two points, *m* and *n*. A straight line perpendicular to that which passes through *m* and *n*, cuts the curve in the vertex A.

DEF. 10.—The line AO being prolonged to cut both extremities of the ellipse, fig. 9, is called the *transverse* or *major* axis.

DEF. 11.—The line AO prolonged backwards to the vertex of the opposite hyperbola, is also called the *transverse* axis of the hyperbola, as in fig. 12.

DEF. 12.—The line through O perpendicular to the transverse axis in the ellipse, fig. 9, is called the *conjugate* or *minor axis*. There is also an imaginary line through O, perpendicular to the transverse axis in the hyperbola, which is also called the *conjugate* axis, and which, on account of its great utility in several operations, we shall show, in our next problem, how to determine in any given hyperbola.

CASE 2.—To find the vertex of the parabola.

Perpendicular to MN, figure 10, draw any straight line, WS, limited by the curve at both ends. Perpendicular to the middle, R, of this line, draw RA: this line will cut the curve in its vertex, A.

PROBLEM III.

To find the conjugate axis of a given hyperbola.

Let O be the centre, and A and B the vertices of the opposite hyperbolas. Draw any line, H*d*, perpendicular to the axis, as likewise AV from the vertex; and on BH describe a semicircle cutting AV in V, and join VH. In VH (prolonged, if necessary) take HS equal to AB, and draw SR parallel to V*d*. Then HR is equal to half the conjugate axis; or, drawing RQ parallel to the axis, we cut the perpendicular from O, so that OQ is the semi-axis in its own place.

* The lines BC, DE, MN, are omitted in fig. 9, to avoid crowding the diagram.

PROBLEM IV.

There are, in the ellipse, two points, in the parabola one, and in each of the opposite hyperbolas one, which have each received the appellation of the focus. The reason of this name will be shown on a future occasion; our present business is to determine them, as we shall have occasion to use them in our immediate operations.

CASE 1.—In the ellipse, fig. 9.

Take the distance, AO, in your compasses, and, setting one foot in V or W, describe arcs cutting AZ in P and P′. These are the foci of the ellipse.

CASE 2.—In the hyperbola.

Find the conjugate axis OQ, and with the distance AQ in your compasses and one foot in O, cut the prolongation of the transverse axis in f: this is the focus. The focus of the opposite hyperbola is to the left of O, at the same distance, fig. 12.

CASE 3.—In the parabola, fig. 10.

From the vertex A draw any line whatever, AO, united by the curve. From O draw OT perpendicular to the axis, and OV perpendicular to AO. From the vertex set off AP in the axis equal to one-fourth of TV, and P is the focus.

(*To be continued.*)

RELATIVE EFFECTS OF STEAM AND GUNPOWDER.

SIR,—Public attention having been directed to the ingenious Steam-gun of Mr. Perkins, a short inquiry into the relative effects of Steam and Gunpowder may not be unacceptable to some of your readers.

Before we conclude that a new engine of greater effect has been discovered for the destruction of our species, let us inquire into the nature of that which we possess, and I am satisfied we shall rise from the investigation startled with the prodigious power which we may carry in a goose-quill, rather than convinced that steam, in the state of the greatest elasticity in which we can use it, will ever rival a power which we may pronounce to be stupendous.

A series of well-conducted and decisive experiments were made by Count Rumford, on the expansive force of fired gunpowder, a detailed account of which, together with engravings of the apparatus employed in so hazardous an undertaking, are to be found in the Philosophical Transactions for 1797: of the facts and the truth of the results, no shadow of doubt can exist, and they, therefore, deserve serious attention.

In these experiments the Count put the small quantity of twelve grains of gunpowder into an iron chamber, of which the bore was a quarter of an inch; weights were placed upon a valve closing the orifice; the powder was fired, and it was found to exert a force of 9431 atmospheres. Seventeen grains, when fired in a similar bore, could not raise a weight of 8081 lbs. placed on a valve which had an area of the 20th part of a square inch; but 18 grains raised that weight, and thus exerted a force equal to 10,977 atmospheres, or 165,000 lbs. on each square inch. In these experiments the powder filled only about half the cavity; hence it expanded to double its bulk, and still exerted this amazing force; but, when the whole cavity, equal only to 1-10th of a square inch, was filled with 26 grains of powder (a quantity insufficient to charge a pocket pistol), the solid cylinder of hammered iron was burst asunder, though it was in every part one inch and a quarter thick, or five times the bore; to effect which would require a force equal to 54,750 atmospheres, or 410,624 lbs. on the square inch. This latter result rests upon a calculation of the force requisite to burst an iron cylinder of the given dimensions. I have examined that calculation, and believe it to be correct; but, whatever doubt may be entertained as to this fact, there can be none with regard to the former—for, in them, the power was estimated by the dead weight which the fired gunpowder actually lifted when placed over an orifice of a given size. In these we find a valve, the surface of which is but the 20th part of a square inch, loaded with nearly four tons, and the elastic force overcomes and lifts it—a fact almost incredible; and, compared

with which, the load on the valve of the highest pressure steam generator that ever was invented sinks into absolute insignificance.

It has been stated that from 700 to 1000 lbs. per square inch is the elasticity of the steam used by Mr. Perkins in discharging pistol bullets. These are fired, in rapid succession, from a single gun-barrel against a metal target 100 feet distant, and they are completely flattened on it; this, however, is not equal to the effect of a horse pistol, and it is much inferior to that produced by the discharge of a musket. The rapidity of the discharge is, however, to be considered; but, if we reflect that coals, water, pipes, a generator, and furnace, are all requisite to keep up the necessary supply of steam, we shall find that as much bulk and weight are attached to a single gun-barrel as would equal that of a field-piece, which, in my opinion, would discharge more grape, and with infinitely greater force in a given time, than the whole of Mr. Perkins' apparatus.

The elastic force, indeed, of steam may be increased by an increased heat, and hence a greater power will be obtained; but, to effect this, there must be a proportionable increase of the size of the generator, pipes, furnace, &c., and this in a much greater degree than is usually supposed even by practical men. It is also to be kept in mind, that there is a limit to the expansibility of steam, which the nature of materials will not allow us to go beyond; and we may presume that no practical use will ever be made of steam beyond one or two thousand pounds on the square inch. Indeed, when we reflect that, at a temperature of 700 degrees Fahr. steam only occupies four times the space of water, whilst, at a temperature of 212 degrees, it expands 18,000 times, we will discover another difficulty in the fact, that one quarter of the power generated would be required to force the water into the generator, which must be proportionably large to raise so much water to so high a temperature, and keep up that constant stream of it which is absolutely necessary for sustaining a continuous discharge of balls even from so small a bore as that of a gun-barrel. What, then, will we think of an attempt to apply steam to the discharge of ordnance? This, indeed, requires no serious attention; and it is my opinion, after a careful examination of the subject, that a 24-pounder steam-cannon, equally effective with our common guns of the same calibre, never will be constructed—the thing is manifestly impossible.

I cannot, however, quit the subject without giving the inventor praise for his ingenuity; for, though it is unlikely to lead to any practical result, it furnishes an instructive and popular illustration both of the effect of steam and the power of the human mind.

A GUN-SPONGER.

IMPROVED PERCUSSION PRIMERS.

We have received, with much pleasure, a series of Reports of the Franklin Institute of Philadelphia, founded in imitation of our London Mechanics' Institution (see page 220, vol. II.), but which has already greatly surpassed it in performance. Besides establishing Lectures, Schools, Libraries, &c. it has offered and awarded prizes, to a considerable amount, for the best specimens of native genius and skill in the mechanic arts; and the merits of the more valuable inventions and improvements submitted to it have been ably investigated and reported upon by Committees of its Members. From these Reports we select the following:—

REPORT

OF THE COMMITTEE APPOINTED BY THE MANAGERS OF THE FRANKLIN INSTITUTE, PHILADELPHIA, TO INVESTIGATE THE MERITS OF, AND ADVANTAGES TO BE DERIVED FROM, THE USE OF JOSHUA SHAW'S IMPROVED PERCUSSION PRIMERS, &c. &c.

These improved Primers are of two kinds; one is generally formed of copper, the other is a composition of pasteboard or other elastic substances. In each of these preparations there is deposited a small portion of any of the fulminating powders known to chemists, of which there are several kinds. Mr. Shaw exhibited two: one of them has been long in use, and composed of oxymu-

riate of potash, sulphur, charcoal, &c. &c.; the other is a later discovery, possessing qualities highly favourable to its universal application, as it is perfectly free from the liability to rust, which is produced by the use of the oxymuriate of potash, hitherto generally known and used, and applicable to either improvement.

The first of these improvements, and which has been patented in the United States, is so generally known, that our observations upon it are almost superfluous; suffice it to say, that, as far as our knowledge of it goes, it has given almost universal satisfaction, and has been adopted by a great number of the most experienced shots in the country, who have uniformly recommended it to their friends, as a very valuable improvement, and perhaps the best extant at the time it was introduced; and its simplicity is such as to induce us to believe it is so nearly allied to perfection, that it will always divide the patronage of the public. It has been applied upon some rifles by order of the authorities at Washington, where it has been tested more than a year, and no objections have at present been advanced. It is perfectly safe in regard to its use and application, and on this point we are more particular, because it has been reported to be liable to accidents; however, whether this be true or false, it is certain that, under its present modifications, such a report must have been unfounded—an evil under which all useful improvements have uniformly laboured for a time. There is, however, one objection which may be fairly urged against it, so long as the oxymuriate of potash shall be employed; but this objection is universal, and applies to every modification of the percussion principle, as it has been the only vehicle in use till within some few months, when a new discovery was made of a metallic preparation perfectly neutral, and, indeed, less corrosive than gunpowder itself; and of this Mr. Shaw has availed himself, so that this objection is now groundless, since the sportsman may take his own choice of either, and the difference of expense is trifling, compared with the advantages to be gained by it.

Mr. Shaw's second improvement is also very simple, and, in this respect, as well as two or three others, we think it preferable to the first. It consists of a piece of pasteboard, not a quarter of an inch in diameter, with a small hole cut or pushed through it; and in this cavity the fulminating composition is placed, and there secured, by wax or other substances calculated to preserve it from injury, and by which it is rendered water-proof when required. This simple preparation constitutes the primer, which, when applied to use, is pressed by a small effort of the finger or thumb into a recess on the breech of the gun; immediately under the primer, and in the centre of this recess, is the touch-hole, which connects it with the magazine or charge in the gun. The cock of the lock is so contrived, that when the trigger is drawn, it shall fall on the centre of the primer, and passing through the hole, or cavity, where the fulminating powder is deposited, causes it to explode, and forces it through the touch-hole beneath it.

The first advantage which we shall notice in this improvement is, that it is not liable to be detached by any accident from the recess in which it is placed, nor is it liable to injury from any common pressure to which it might be subjected by carrying loose in the pocket, and may therefore always be relied on; and if oxymuriate of potash be used, it is less liable to injure the gun by rust, than it is when employed in any other way, as the paper absorbs a material portion of the pernicious refuse thrown off by the explosion, and the remainder escapes without settling upon the lock.

The next advantage which this improvement embraces is, that the primer is brought into closer contact with the charge or magazine, and may therefore be considered as being better also. Where arms are kept loaded for any length of time, with the intent of being used on sudden or unexpected attack, this primer is not subject to spoil, or contract rust or damp about the lock, and is as quick and as certain of fire, as if loaded and primed but five minutes before; and in nice shooting, particularly with respect to rifles, it appears to be entitled to a preference; and, in common with the first of these improvements, it will admit the cock to rest upon it with safety—an advantage calculated to prevent two-thirds of all the accidents attendant on field sports; and the sooner this improvement is known and brought into universal use the better, as it embraces every facility that can be required; and, combined with the use of the metallic powder, as shown and exhibited to us, constitutes, in our opinion, the best possible means by which fowling-pieces can be discharged, and as worthy of the attention of the Government as it is of the public generally; and, in addition to our own opinion, we have the evidence of some experienced sportsmen who have tried it, and their testimony goes to confirm what we have here advanced in its behalf.

P. S. This last improvement of Mr. Shaw's was placed four minutes under water, and, notwithstanding, it exploded with as much vivacity as if nothing of the kind had taken place.

D. H. MASON.
ISAIAH LUKENS.
JOHN S. PHILLIPS.

Philadelphia, 1st July, 1824.

STRENGTH OF LEATHER

SIR,—Mr. Bevan lately gave you the result of some interesting experiments on the Strength of Leather; but, in consequence of his not having stated precisely the mode of trial, I would beg the favour of an answer to the following questions:—

1st. Did the leather extend equably throughout the length?

2dly. Did the fracture commence at one side in any of the trials? And,

3rdly. Did he observe a loss of elasticity in the straps after they had been weighed to a certain extent?

I am, Sir, &c.

A, B, C, &c.

ON HAMMERING.

SIR,—I would be thankful to our kind friend, Mr. Bevan, if he would state the weight of hammer corresponding to the different velocities given in his last letter.

Professor Robison has given 25 feet as the mean velocity with which a carpenter hammers. — (See Dr. Young's Nat. Phil. vol. II. p. 206.)

I am, Sir, &c.

A CARPENTER.

CORRESPONDENCE.

A Correspondent, adverting to the 39th volume of the Transactions of the Society of Arts and Sciences, in which there is given an account of an instrument invented by Mr. Allan, of Blewit's Buildings, for dividing the arches of sextants, &c. wishes to know if the ingenious inventor is yet living; and if not, whether his instrument is now in use, and in whose hands; as he does not remember having seen any sextants divided upon his principle. The same Correspondent also inquires whether Mr. Stancliff, whose sextants stand in such high estimation, be now alive; and if any sextants of his make can be now procured, and where?

The insertion of the description of Napier's Bones is delayed for the sake of an illustrative engraving, which we have found necessary.

A Reader at Wareham wishes to know where the Woolcomber's Steam Chests, described by our Correspondent, Mr Saul, of Lancaster, can be procured, and the price of one complete.

"Philopat." will please send to our Publishers' for letters addressed to him.

"Humanitas" should be more specific in the description of his inventions.

We shall be glad to hear again from J. S.

T. M. B., whose letter was *all Greek*, objects with a bad grace to our flinging a scrap of *Latin* at him. We are glad, however, to find that he is of a forgiving disposition, and that we may hope again to rank him among the number of our useful, *matter-of-fact* contributors.

Communications received from—A. R. Poole—A Carpenter—A Subscriber—S. Z.—Query—Edward Rider—J. S.—Museum—Lapis—Insectum—A Wharfinger—An Operative Millmaker—Alexis—S. Wardner—H. Toller—B.—N. A—Straight Line—A Wellwisher—Incredulous—F Fenton—G. W.—Gemtun—Robertus.

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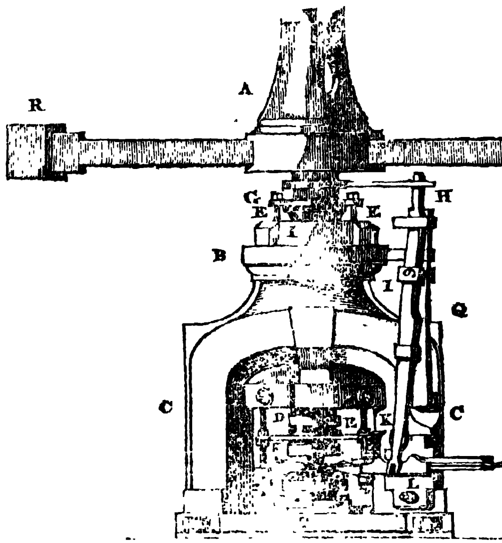
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

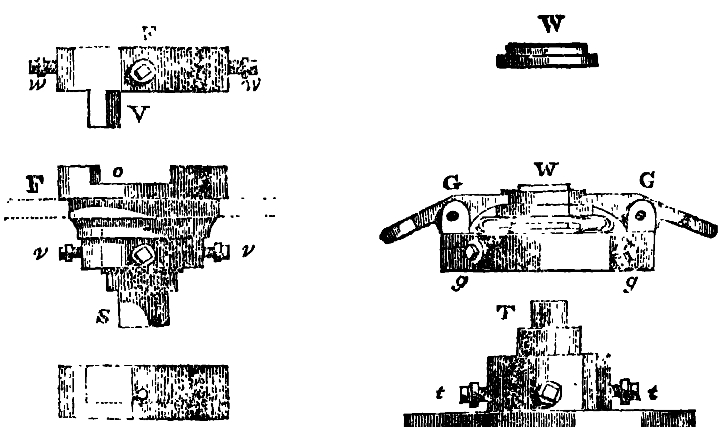
" He who conceals an useful truth, is equally guilty with the propagator of an injurious untruth."—*Augustine.*

No. 66.] SATURDAY, NOVEMBER 27, 1824. [Price 3d

PROCESS OF COINING AT THE ROYAL MINT.

(Continued from our last Number.)





PROCESS OF COINING AT THE ROYAL MINT.

We now proceed to give a description of the Coining Press, an elevation of which is exhibited in the first of the preceding drawings. CCC is a strong cast iron frame, screwed down on a stone basement; the upper part is perforated perpendicularly, to receive the screw, D. One of the steel dies which strike the coin, is fixed to the lower end of this screw by a box, fig. 4, and the other die is fixed in a box, fig 7, which is fastened down upon the base of the press. The heavy balance weights, RR, are fixed on the top of the screw, which, being turned round, press the upper die down upon the blank piece of coin, which is laid upon the lower die, and gives the impression; a sufficient force being obtained from the momentum of the loaded arms, RR. The motion is communicated to the screw by a piece, A, which ascends to the cieling of the coining-room, and is worked by a steam-engine, with machinery, in the apartment in the room over the coining-room.

Eight presses, similar to this, are placed in a row upon the stone basement, and very strong oak pillars are erected upon the basement, and reach to the ceiling. Each press is contained between four such pillars, and iron braces are fixed horizontally from one pillar to another on the opposite side. These braces support blocks of wood, against which the ends, RR, of the arms strike, to stop them from moving farther than necessary, as, without such precaution, the hard steel dies would sometimes come in contact, and be broken. The piece of blank coin is contained within a steel ring or collar, whilst it is stamped, and this preserves its circular figure. The ring is shown at a large size at W. V, fig. 2, is a three-pronged spring, which always bears the spring upwards; the opening through the ring, W, is made to fit upon the neck of the lower die, T, fig. 7. When the ring is dropped upon the neck of the die, the upper surface of the ring and of the die will be in one plane. The ring admits of being raised up upon the neck, and will then form a recess or cell, which is just adapted to receive a piece of money. The collar, W, is made to rise and fall upon the neck of the die by means of the levers, GG, fig. 6; these are fitted upon centre-pins or joints, in a large ring, *gg*, which is placed on the outside of the box, fig. 7, containing the lower die, T, and is fixed fast upon it, as shown in fig. 1, by clamping the screws, *gg*. The levers, GG, are forked at the outer ends, to admit studs at the lower ends of iron rods, EE, which rise up through holes in the solid metal of the press, and are united to a collar, G, fitted on the upper part of the screw, D. When the screw of the press is turned back, and the upper die is raised up, the rods raise the outside ends of the short levers, G, and the inside depresses the ring; a blank piece of money is laid upon the die, and when the screw is turned to bring the upper die down upon it, ready to stamp the impression, the levers, G, are released, and the triple spring, V, lifts the collar up, so that it surrounds the piece of money; and in this state the blow is struck. Immediately after, the press returns by its recoil, and then the levers, G, force the collar down upon the neck of the die, and leave the piece free. The lower die is fixed in a box, fig. 7, by the screws, *tt*, which admit of adjusting it with precision beneath the upper die. The box, fig. 7, is screwed down upon the base of the press by four screws. The upper die is shown at S, fig 3, which explains how it is fastened to the screw; *rr* are four screws, by which the die is held in a box, fig 3. The box is fitted into a ring or collar, as shown by the dotted lines, F; see also fig. 1. The arms of the collar, F, are attached to the rods, EE, by two nuts at each end; and this makes the collar, F, and the box, 3, always follow the screw, and keep a close contact with the end of the screw, which enters into a cell on the top of the box, fig. 3, but leaves the screw at liberty to turn round independently of the box

Fig. 2 is a ring, which is fastened by its screws, *ww*, to the screw of the press; a claw, V, descends from the ring, and enters into the cavity, *o*, in the edge of the box, fig. 3, which cavity is nearly three times as wide as the claw, V, and therefore allows the screw to turn round for a certain distance without turning the box, fig. 3; but beyond the limits of this motion the screw and the die will turn round together. The intention of this is to press the upper die down upon the coin with a twisting or screwing motion; but if the die was to rise up with a similar motion, it would abrade and destroy the fine impression; for this reason the notch, *o*, is so wide as to allow the screw to return, and raise the die from immediate contact with the coin, before it shall begin to turn round with the same motion as the screw.

Fig 4 is a box, which is screwed over the box for the upper die, as shown in fig. 1, in order to keep the upper die firm in its cell.

The great screw of the press is made cylindrical at the upper and lower ends, as represented in figure 1, and their ends are accurately fitted in collars, which are bound tight by screws, the real screw or worm is partly concealed within the solid metal frame, and has no other office than to force the die down, the guidance laterally being effected by the collars.

HISTORICAL RECOLLECTIONS OF COINING MACHINERY.

Previous to the reign of Charles II. the money in circulation in this country was made by forging or hammering slips of gold and silver to the proper degree of thickness, then cutting a square from the slip, which was afterwards rounded and adjusted to the weight of the money to be made; the blank pieces of money were then placed between two dies, containing the design of the coin, and the upper one was struck with a hammer. This money was necessarily imperfect, from the difficulty of placing the two dies exactly over each other when the blank piece was between them, as well as from the improbability of a man being able to strike a blow with such force as to make all parts of the impression equally perfect.

The mill, or press, was first introduced from France into this country in the reign of Queen Elizabeth, but, after a few years use, was abandoned, as too expensive, and the hammer coinage resumed.

The coining-press, or mill, is of French origin, and is generally ascribed to Antoine Brucher, an engraver, who, in 1553, first tried it in the French king's (Henry II.) palace, at Paris, for the coining of counters. It continued in use till 1585, in the reign of Henry III. when it was laid aside on account of its being also more expensive than the hammer coinage. The machine remained in disuse until 1623, when Briot, a French artist, who was unable to persuade the French Government to adopt it again, came to England, where it was immediately put in practice under Briot's direction, who was appointed chief engraver of the Mint.

Like many other new inventions, it was sometimes used, then laid aside, and the hammer resumed, for about forty years. In the year 1662 the mill and screw were completely established in the English Mint, as it had been by the French in the year 1645. The great improvement which took place in the form and impression of the coin struck by this new invention, gave them a decided superiority over the hammer-money; and the excellent and truly philosophical improvements of the late Mr. Bolton, described in your Magazine, page 245, vol. I. have placed the process of coining upon a basis so firm, and so decidedly superior, both in facility and economy, that we need be in no fear of returning to the ancient and less perfect mode of fabricating our money.

G. H.

LIFTING SHIPS BY STEAM.

Sir,—Having experienced much inconvenience once, from the necessity of unloading a vessel in shoal water, I have long thought whether the desired object might not be obtained by pneumatic means. But since so much information has been diffused respecting the nature and power of steam, I conceive, if it were practicable by that power, very essential service might be derived from the application of it to lift ships, so as to lessen their draught for even a small space of time. A valuable ship and cargo might be saved from ruin by the reduction of a foot, or perhaps less, of draught; and many advantages might be taken of navigations that are at present attended with delay, labour, and expense. It might also save much money in the constructing of docks. I shall, therefore, hasten to the subject, or rather to communicate a few hints on the subject; leaving it to the judgment of your numerous readers whether any of them be practicable or otherwise.

The expansive power of steam, when let into a cubical vessel, is equal on all sides: to avert the effects of pressure on one side, is the *desideratum*. The question is, could steam be sent into a similar vessel, but open at bottom, and resting in, say a foot of water, so fast and in such quantity as to press the sides and top equally, as if there were no condensing water in the way? If so, the vessel being fastened to the ship, the latter would be lifted. Would not, then, the continuance of the supply of steam prepare the water, so as to prevent universal condensation; and might not that state of the water be kept up, by the water being changeable, or by a supply from without? Lastly, with a fire-pan underneath a vessel or iron tank of the size of its bottom, so as to admit of the bottom being ignited, and w[illegible]. a tunnel through the centre of the bottom to carry off a portion of the steam, but projecting some inches in the vessel to retain the water, might not water be gradua injected through the top or side, for

purpose of being converted into steam; and would not the difference of pressure on the top and bottom effect considerable [illegible]? This question is to be answered by the perfectibility, or the contrary, of Mr Perkins's steam rocket.

However erroneous these suggestions may prove, it may nevertheless elicit something new; as we soon discover where the south lies, by having its opposite pointed out. More likely, like Newton's apple, it may fall to the ground, fully ripe, and of course destined to decay, although some, to this day, consider that windfall imperishable.

Chatham. T. H PASLEY.

ON WIGHTMAN'S PERCUSSION GUN

SIR,—Your Correspondent "S. R." [illegible], in his illustrations of the Marquis of Worcester's Century of Inventions, has thought proper to animadvert on a Percussion Lock, constructed by me, a description of which appeared in the early part of your work, [illegible] introducing another, [illegible] Beckwith. He commences [illegible] stating, or rather *thinking*, that [illegible] gentleman who committed [illegible] to your pages seen the lock and [illegible] invented by Mr Beckwith, of [illegible]-street, that he would not have [illegible] up mine so much. Now, Mr. Editor, what must be the wonder of this illustrator, when I tell him that the "Admirer of Field Sports" first used Forsyth's percussion lock, and had it afterwards altered to Beckwith's invention; namely, to a magazine sliding on a bar, every part of which is exposed to wet, but more particularly the pan, so that it is necessary to unscrew and clean it very frequently. After [illegible] this lock, however, a short time, such was his opinion of this excellent invention, that he returned to Forsyth's again; which he used with satisfaction until the gun was brought to my shop to repair, at which time he saw the lock described in your pages, and, without hesitation, adopted it.

"S. R" objects to its being too complex, liable to get out of order, and requiring a degree of skill to repair it beyond what ordinary *gunsmiths* possess. Now, Sir, allow me to ask in what the complexity consists? The apparatus is nothing more than a cylinder, passing through the line of communication between the pan and the chamber containing the powder, and which primes the gun by simply turning the cylinder half round.

Your Correspondent's recommendation to avoid the *occasional necessary increase of the charge of powder*, is calculated to benefit [illegible]makers generally, as much as his denunciation was intended to injure me: for it is well known to all shooters, except "S R" that guns recoil when overloaded; and that if the recoil were firmly resisted, as would be the case by attending to his advice, the stock would be broken to pieces.

I am, Sir,

Your most obedient servant,

W. E. WIGHTMAN.

Malton, Nov. 15, 1821.

FRAUDS IN THE COAL TRADE

SIR,—Your Correspondent R., in his information on the abuses committed in the Sale of Coals, seems to intimate, that the fraudulent dealer would not be induced to mix water with coals, if he were compelled to sell coals by weight; because, he says, a bushel of wetted coals weighs lighter than a bushel of dry coals, inasmuch as the dust of the dry coals insinuates itself into the interstices between the larger pieces of coal, and makes the mass almost as ponderous as if it were solid; whereas the particles of small coal, when wetted, do not easily pass into the vacant places, and a bushel of wetted coal weighs less than a bushel of dry coal. But R. does not recollect, that if to one hundred weight of coals, one quarter of a hundred of water be added, and mixed, the entire mass will certainly weigh a hundred weight and a quarter; and, at the same time, it will be practically found, that the volume of the mass is greatly increased; and that, although one measure of the mixture would weigh lighter than a measure of dry coal, yet that there are so many more measures of the mixture to be sold than there were of the dry coal, that, by selling the whole weight, the dealer would be much a gainer by the fraud.

I am, Sir,

Your sincere wellwisher,

A SURREY FARMER.

November 4, 1821.

HORIZONTAL CYLINDER AND PISTON.

SIR,—In answer to the inquiry which you appended to my description of a Horizontal Cylinder and Piston, inserted p. 289, vol. I

have to state, that the improvement never has been reduced by *myself* to practice; but conversing with a respectable mechanic on the subject, he informs me that he has erected a machine, similar to that suggested by me, for raising water.

I am, Sir,
Your most obedient servant,
R. M'VEY.

NEW VOLTAIC-MECHANIC AGENT.

Fig 1

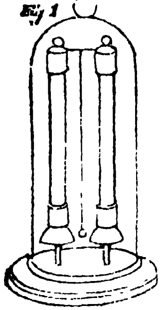
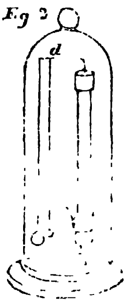
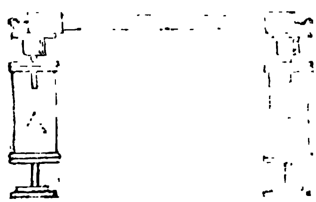


Fig 2





In the last Number of "The Chemist," its Editor has promulgated what he considers to be a discovery, applicable to so many useful and important purposes, that it may change and improve the condition of mankind. After giving a description (which we shall subjoin) of Mr. Singer's electric columns, which produce, by the continued production of electricity, a *perpetual*, though not an equable motion, he thus proceeds:—

"This principle has only been hitherto applied to make mere toys. But the Voltaic battery, the most powerful instrument with which science has yet armed the hand of man, presents a continual renewal of the electric current, in the same manner as the pile of De Luc, but in a prodigiously more intense degree. Why cannot we apply this instrument to produce a perpetual mechanical power? The Editor believes we can, and he proposes its application in the following manner:—

"All the world has lately heard of Mr. Brown's pneumatic engine, in which the source of the power consists in burning hydrogen, or some combination of hydrogen gas, in *atmospheric* air. Mr Brown finds it very difficult to get rid of the *nitrogen*. But if we decompose *water* by means of galvanic electricity, as every one knows we can, we produce abundance of oxygen and hydrogen, in those exact proportions in which they combine, and, when flame or the electric spark is applied, condense each other, and produce the most perfect vacuum which perhaps the art of man can form. The Editor of The Chemist, therefore, says, that a new power, hitherto never thought of, never put to any use, may be generated by decomposing water by means of galvanic electricity, and recomposing the resulting gases by means either of flame or the electric spark. By this means we generate a power (*the two gases*), in the first place, equal to an additional atmosphere; and when we have thus generated this atmosphere, we may form a perfect vacuum by inflaming and condensing the gases. We have first a power equal to the atmosphere, which Mr. Brown does not produce; and next we have a far more perfect vacuum than he can possibly form. The volume of the gases is diminished near two thousand times. The application of this power, first to raise a piston, and afterwards to let it fall into the vacuum we create, is too obvious to need, at present, further explanation. Thus, by a continued production of electricity, which is generated by a Voltaic battery, we may go on for ever decomposing and recomposing water, producing, to the end of the world, an enormous power, with apparently inadequate means."

The Editor, with a liberality as rare as it is praiseworthy, adds—

"There is no mystery, he believes, hanging over this statement—no quackery,

is plain and palpable, and such as it is he throws it open and patent to all mankind, to make the best use they can of it."

The electric columns of Mr. Singer, alluded to in the outset, are constructed on a similar principle to that of De Luc, of which it may be proper to premise a few particulars.

"When bodies are broken asunder and ground to powder, opposite states of electricity are produced. In the case of metals, it is invariably found that the most oxidizable of any two metals always acquires positive, and the least oxidizable negative electricity. If we place ever so many series of the different metals in contact, we shall not increase this effect; but it occurred to Volta, that if a series of metals were to be rendered electric by induction, there would be an accumulation of electricity. Accordingly, if we place a plate of zinc and copper with a piece of moist paper between them, we get such an increase of electricity as to make it manifest by the electrometer. A very ingenious instrument of this description is the electrical column, invented by De Luc. It consists of a great number of small plates of silver, tissue paper, and zinc, placed alternately, and enclosed in a glass tube. When the number of discs or plates is great, as 300 or 400, the electricity which is excited becomes very sensible; and it is found that the end terminated by zinc is positive, and the end terminated by a disc of silver negative. Such an instrument was employed by the Professor to communicate electricity to an electrometer, and it was found, by examining the electricity with a stick of sealing wax, that with the zinc end positive, and with the silver end negative, electricity was imparted. When the opposite ends of such a pile are united, there is a constant current of electricity passing between them. If the pile be insulated, its electricity is feeble, and is increased by being connected with the earth by the hand, or rendered not insulated by any other mode. There is in this instrument then the two electric poles, and in the centre plates there is a point where there is no action whatever. It corresponds, therefore, strictly with those conductors or electrics in which electricity is produced by induction, and only differs in the circumstance of there being a perpetual renewal of electricity in the pile."

Mr. Singer's application of this principle is thus described:—

"The figure, No. 1, represents two such columns, placed vertically in a glass receiver, having a bell fixed at the lower extremity of each, and having a brass ball suspended between them, by a very fine thread of raw silk. Mr. Singer, who constructed this apparatus, found that the production of the electricity was so continual, that the bells never ceased to ring for fourteen months, except during its removal from place to place. For six months it was never disturbed, and there was then no interruption whatever to the ringing. In Mr. Singer's opinion, the action of a well-constructed column will be permanent; he had some that, after being three years constructed, were still as active as ever. To keep it in good order, however, the two ends should not be connected by a conducting substance for any length of time; and it is therefore necessary, when a column is laid by, that it be placed on two sticks of sealing-wax, so as to keep its brass caps about half an inch from the table. A column, which appears to have lost its action from lying by, will generally recover its powers when insulated in this way. Too much moisture also destroys it. An increase of temperature increases its power In winter, Mr. Singer's bells always ring slower than in summer; and when a fire is made in the apartment, their action always increases.

The aerial electroscope is an instrument for determining the electric state of the atmosphere, and this is another use to which De Luc applied his column. It is placed vertically within a glass receiver, and consists of from one to two thousand series A bent wire, having a ball at its lower extremity, is connected with the upper extremity of the column, so as to hang parallel to, and at some distance from it; opposite to it is a similar ball, screwed into the lower cap of the column: a brass fork prevents the first ball from striking against the column, which it would otherwise do. The pendulum consists of a fine silver wire, suspending a gilt pith ball.

KEY TO ELLINGTON'S PATENT LOCK.

Sir,—In consequence of the notice in your Magazine, there have been so many applications at my warehouse for "Ellington's Patent Locks," that I shall feel obliged by an early insertion of this letter, in order that the public may no longer be deceived.

I have written down to my agents at Wolverhampton, and, from the best authority, you may rely on it there neither is, nor even was, such a man in the lock trade. I have also searched the register of letters patent, and none has been granted in that name.

Your obedient servant,

J. E. Sparrow,
Ironmonger, Bishopsgate.

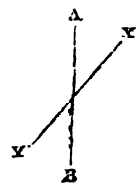
Nov. 16, 1824.

REHEARING
***In re* LONG AND SHORT-HANDLED SCREW-DRIVERS.**

SIR,—Having originally given the opinion on J. Y.'s question on this subject, which has subsequently produced such a *long thread* of useful discussion from others, I hope you will allow me the usual courtesy of a reply.

Mr. Nichol Dixon certainly *handles* me a little roughly, and although courted by him to renew the subject, I confess I did not like to take the field again with such a *powerful* adversary; and let me take this opportunity of recommending to him, and, indeed, to all your Correspondents, to peruse the excellent motto prefixed to No. 59 of this Magazine—"Theoretical and practical men will most effectually promote their mutual interests, not by affecting to despise each other, but by blending their efforts"

My thanks are due to your Portsmouth Correspondent, D. H. In—y, in your 64th Number, and also to the author of the letter which immediately follows, signed "Screw," who have both felt for me, and have, in part, advocated my cause; but here I must be allowed to say, that I have been completely misunderstood by them all, for it will be seen, on reference, that I never asserted that the *perpendicularity* of a long screw-driver increased its power. The question was this, "What is the reason why a screw-nail is *screwed home much easier* with a *long* than with a *short* screw-driver, the handles in both cases being alike?" The opinion I gave is already before your readers, and after all that has been said, I will be *hardy* enough to maintain that opinion. I am aware that I might have used a more scientific term than *perpendicularity*, because, in driving a screw horizontally, it would not strictly apply, but I believe most of your readers understood what was meant. I now submit that it will appear evident to every thinking man, that in driving a screw in the direction of AB, if he apply a force in the direction of XY, he is not taking the easiest method, and that the consequence will be the effects stated by your Correspondent "Screw," viz.—that his face will be disfigured, his cloven head mutilated, and the bed torn and defaced by the unequal bearing against one side.



The increase of power never entered into my head, for, in common practice, I believe that too much power is generally applied, where a little patience and perseverance would be more successful.

I am not ignorant by what means the screw-driver may be converted from a single to a powerful double lever, and I have also found, from experience, that the elasticity of this tool often prevents the mischief deprecated by "Screw;" but the time is now come that I must confess my ignorance, and candidly avow that I do not comprehend how power is gained by this elasticity. The matter seems ably *handled* by your Portsmouth friend, and if he will, at his leisure, try once more to *drive* it into me, he will add to the obligation already conferred on, Sir,

Your obedient servant,

Nov. 14, 1824. A.

SIR,—I observe, in the 64th Number of your Magazine, a letter signed D. H. In—y, on the subject of Screw-drivers, in which the writer, after animadverting a little on the opinions of some of your Correspondents who had handled the subject in the two or three foregoing Numbers, proceeds to tell us that, because in the use of the lever, when the acting power travels faster and farther than the resistance, power will be gained; that, therefore, an elastic screw-driver gains in power, because the handle travels faster and farther than the point. Here, however, it unfortunately happens that this same additional space which the handle tra

vels through, is performed before the power begins to act on the resistance at all (for the screw will not move till the driver is twisted as much as its elasticity will allow); so that the idea is equally absurd as it would be to assert that, in using the pulley, a considerable advantage would be gained by having a good length of slack rope to pull in before it began to act on the weight; or that an elastic lever, the end of which, by bending, would travel a good way before the resistance moved, should possess a considerable increase of power.

In my opinion, the chief, if not the only advantage of a long screw-driver, is that mentioned by your Correspondent "A." although the idea is hooted by Mr. Nichol Dixon, viz. that it is more easily kept in the line of the screw; for it is evident to every one, that if a man's hand, in turning a screw, vary a certain space from a straight line, the nearer the hand is to the screw it will be the worse; and it is plain, also, that a screw will go in more easily when the pressure is in the line of the screw, than if it is pressed against the side of the hole, which it must be if the driver is out of the line.

I am, Sir, &c.

Nov. 16, 1821. X. Z.

Sir,—As I do not esteem either of the answers to J. Y. on the Screw-driver (page 60, vol. III.) at all satisfactory, allow me to contribute a few lines on the subject: not wishing to trouble you with a diagram, I will endeavour to describe my meaning without one.

The principle of a screw-driver may be represented by two pieces of wire crossing each other, so that two ends may represent the small end of that tool, and the other two the *usual* diameter of the handle. If these wires are turned in the manner of a screw-driver, they will be found to act as levers in opposition, each forming a fulcrum to the other; and if the wires are then reduced to half their original length, the same distances being observed for the small end of the tool and the diameter of the handle as before, the reason will be made evident to any one knowing the principle of the lever, why the long turn-screw will produce the greatest power; because there is a greater proportional difference from the points where the levers come in contact.

I am also perfectly satisfied that the less *elasticity*, and the more the tool is kept perpendicular, the better, both for the operation of driving the screw as well as the preservation of its head.

I am, Sir, &c.

Guildford, Nov. 16, 1824. r.

INQUIRY

NO. 78.—LIME-BURNING.

Sir,—Any of your Correspondents would much oblige me, who would inform me, through the medium of your Magazine, what are the most eligible form, dimensions, and construction, for a small Lime-Kiln, intended for the burning of lime, for the purposes of manure, from chalk, with furze or whins (*ulex Europæus*); and whether the same shape of kiln will equally admit the burning of lime with coal or with turf; by which name I mean not pure peat, but the heathy sward pared from a black, moory, or peaty siliceous soil, with its growth of heath, grass, and some petty whins; and what ought to be the expense of constructing such a kiln. The materials which can be most conveniently procured in the neighbourhood, are brick-clay, rather overcharged with argil, hard chalk, limestone, and lime; stone grit, or siliceous limestone, which is often used as firestone. Any information on the choice, mixture, or position, of the materials for the building; on the choice, or mixture, and comparative utility and strength, of the fuel; and on the choice of the harder or the softer chalk, for the purpose of lime for manure (as I have both); and on the size to which the chalk should be reduced before it is put into the kiln; and also references to any approved works on the subject,—will be thankfully received. S. F.

PRACTICAL GEOMETRY; BY T. S. DAVIES.

(Continued from Page 141.)

Cuts referred to in our last Number.

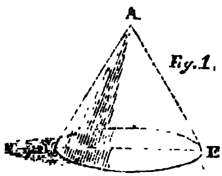


Fig. 1.

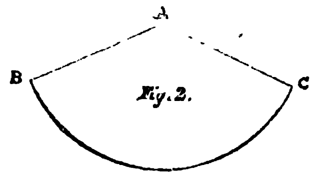


Fig. 2.

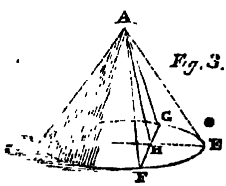


Fig. 3.

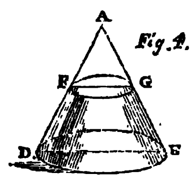


Fig. 4.

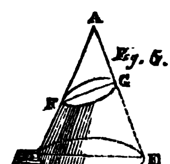
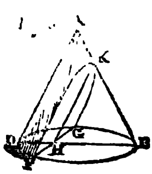


Fig. 5.



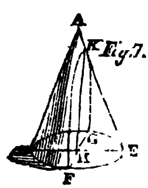
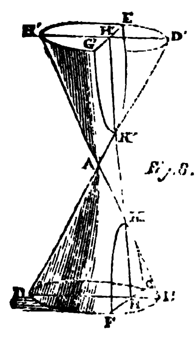


Fig. 7.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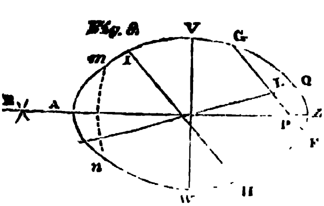
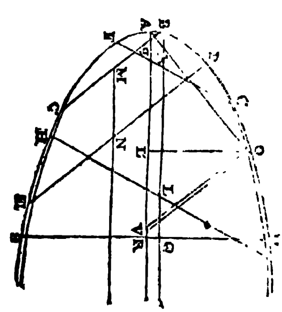
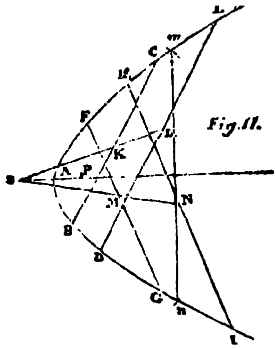
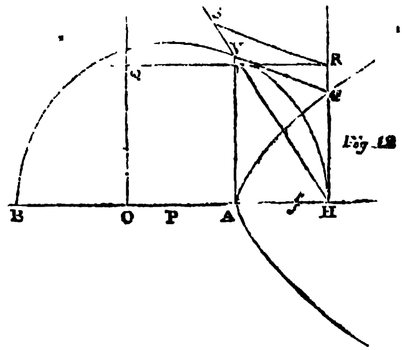


Fig. 9.



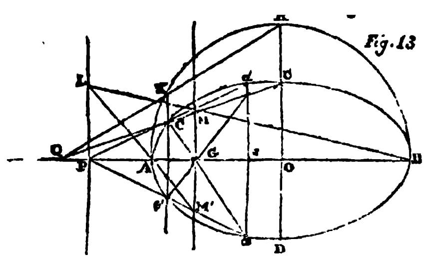
Cuts referred to in our last Number.





PROBLEM V.

Having given five points, one of which is the vertex, and the other two pairs, at equal distances each to each above and below the axis, to find the character of the conic section which would pass through the five points, fig. 13.



Let A, C, *e'*, *d*, *d'*, be the five given points. Join C*d'*, *e'd*, crossing each other in G: draw also C*d*, *e'd'*, meeting in P, and draw the indefinite straight line through PG. Parallel to C*e'* draw a line through G, cutting C*d* and C*d'* in M and M', and another through P, indefinitely extended. Let a line pass through M'A, cutting the line PL in L, and another from L through M, cutting the line PG or its prolongation in B.

To determine the section we have only to observe,

1. That when AG is less than AP, the curve will be an *ellipse*, of which the circle is to be considered a variety.

2. When AG is equal to AP, the curve will be a parabola.

3. When AG is greater than AP, the curve will be an hyperbola.

4. When A coincides with P, the section is a triangle

The reader will find that, according to the species of the curve, the line LK will cut the transverse axis on the side to which the curve bends, will be parallel to the axis AO, or will cut it on the outside of the curve, *de'* A *e' d'*.

PROBLEM VI.

To find the minor axes and foci of the sections which will pass through these five points, and thence furnish the requisite conditions for describing them on a plane surface.

CASE 1.—For the ellipse.

The line AB, fig. 13, is the transverse axis on which we must describe a semicircle, and draw OR the perpendicular radius. Prolong also C*e'* to cut the circumference in K, and let the straight line passing through KR cut AO, or its prolongation in Q. The line QC' will cut OR in C', so that OC' will be half the

conjugate diameter. The focus is found by Prob. IV. Case I.

CASE 2.—For the hyperbola.

Let H a, in fig. 12, represent H d in fig. 13, and the transverse axis, AB, be found by the operation described in the last Problem. The semi-conjugate axis and focus is found, then, by Prob. III.

CASE 3.—For the parabola.

Consider A the vertex, AR the axis of the figure, and O a point in the curve. Then find the focus by the operation in Prob. IV. Case 3.

Note.—The mode of tracing the sections upon a plane, when the axis and focus are given, will be detailed in a future paper. The elementary Problems we have given will suffice for conducting us through the remaining parts of this paper. The method of describing a conic section through any five points whatever (no three of which are in one continuous straight line) was deemed also unnecessary in the present stage of our progress.

DEFIN. 14.—The *angle at the vertex of a cone* is that angle which is formed by a plane section through its vertex, and dividing the cone into two equal parts, or when the cone is "slit down the middle."

PROBLEM VII.

To find the angle of a cone.

Take any three points, G, K, L, at equal distances from the vertex, fig. 14; and, by Prob. I. No. I.* transfer the circle in which those three points are posited to a plane, fig. 15. Upon

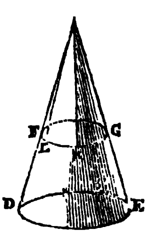


Fig. 14

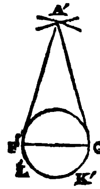


Fig. 15.

* See page 70.—In future the reference to pages will be omitted, as unnecessary, it being deemed sufficient to quote the *number* of the paper and the *number* of the Problem in that paper.

the diameter of the circle, as above, with the sides, A'G', describe an isosceles triangle, F'A'G'. The angle F'A'G' is the angle of the cone, or as we shall sometimes find a convenience in expressing it, F'A'G' is a *vertical section of the cone.*

PROBLEM VIII.

To draw through any point upon a right cone (whose base is a circle a line which tends to the vertex of that cone.

With centre C and any convenient radius, describe a circle cutting the base in m and n, fig. 20. Bisect the arc mn in k, then kC will tend to the vertex.

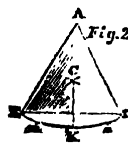


Fig. 20.

Note.—This method is precisely the same as that adopted in Prob. VIII. No. I. for tracing a line parallel to the axis of a cylinder, and it equally applies to all those regular bodies which are termed "solids of revolution," or which, to speak more familiarly, could be produced by turning upon a common lathe. The method may be advantageously applied to finding the direction of the flutes and fillets upon columns, as well as many other practical purposes. Mr. Nicholson did not seem to be aware that such a process was necessary for finding the original direction of the revolving radii prior to fixing the rule in his very ingenious contrivance for tracing those lines upon a column; or, perhaps, he deemed that the correspondence between the rule and the shaft would determine when the rule was accurately placed—an opinion which I should suspect the practical accuracy of; bending, however, with the utmost regard for the authority of so eminent an architect as he unquestionably is. I leave the matter, however, in the hands of practical men, and shall feel satisfied with their decision.

PROBLEM IX.

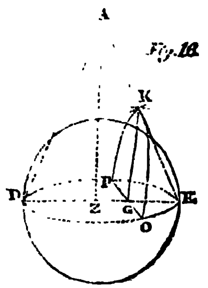
Having given a portion of a right cone, whose base is circular, to find the original dimensions of the cone.

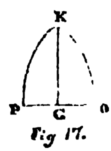
CASE 1.—When the vertex is a portion of the given fragment of the cone.

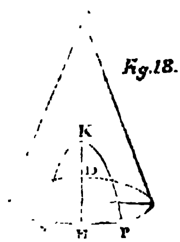
This may obviously be effected by Prob. VII.

CASE 2.—When the given section cuts the base.

Find the circular base by Prob. I. No. 1., and let DB be the diameter. Find also, by Prob. II. of this paper, the axis of the given section, GK, fig. 17. Upon the conical surface join K and E.

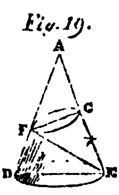






Take EG, in the line ED, in your compasses (figure 16), equal to the portion of the diameter of the base cut off by the section; and upon this base, with the axis of the section, KG, and the line formed upon the slant side of the cone (fig. 18), describe a triangle, GKE (fig. 16). From the centre, Z, of the circle raise a perpendicular, ZA, and prolong EK to cut it in A. Join AD, then DAE is the vertical section.

CASE 3.—When the given section cuts the opposite side, as CD, fig. 19.



Find (Prob. II.) the vertices, F, G, of the ellipse; draw lines, GE, DF, tending to the vertex of the cone, by Prob. VIII., and cutting the base in A and B.

Transfer the distance, EF, to a plane, and upon it describe the triangles, FGE, FDE, with the distances, FG, GE, and FD, DE.

The lines DF, EG, prolonged to meet in A, give the vertical section.

PROBLEM X.

I shall conclude this paper with the solution of the case of finding three points in the same circular section of a right cylinder, when the end of the cylinder is not circular, which was referred to in Prob. VIII. of No. I.

Find the transverse, CL′, and conjugate axis, TT′, of the elliptic end, fig. 22; set off the semi-transverse, SL′, fig. 23, and upon it describe a semicircle, S′WL′. With the semi-conjugate, SS, fig. 22, describe an arc, whose centre is L′, to cut the semicircle S′WL′ in W, fig. 23. Upon WL describe the semicircle WNL′, and bisect it in N. Then, in fig. 22, with NL′, of fig. 23, as radius, and L as centre, describe an arc, *mn*. With centre T, fig. 23, and radius S′W, of fig. 23, as radius, describe another arc cutting *mn* in S″. Do the same on the other side of the cylinder. The points SL′S″ are in a circle.

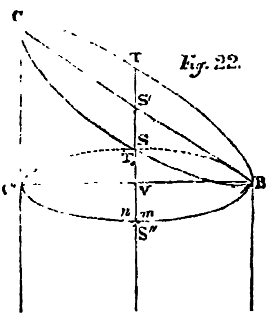
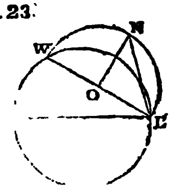


Fig. 22.

Fig. 23.



Note.—Any ot er circle may be found at any distance from this, by an application of the Problems in No. I.

When the ends are either inaccessible or not cut by a plane, the Problem does not appear to admit of a solution perfectly in the spirit of geometrical construction, or one in which the ruler and compasses alone are used. Perhaps the best practical method may be to wind a thin piece of flat brass wire round the surface of the cylinder, and trace the circle by its edge. Indeed, it may be better, in all cases where a circular section of a cylinder is wanted, to adopt this method, which must necessarily be correct when the wire will perfectly coil upon itself, or, when being wound into a coil, every point of that coil will touch a plane surface upon which it is laid. There is, however, some uncertainty attached to this test, and, therefore, when it can be done, it may be better to verify the operation by the methods of the Problems already given for the cylinder.

Bath, Nov. 5, 1824. T. S. D.

(To be continued.)

RUTHVEN'S ECCENTRIC WHEEL.

Sir,—In Number 63 of your Magazine, I find a description of a new application of mechanical power by Mr. Ruthven. I beg to acquaint you that the same has been in action above two years in my manufactory, where it is employed to give an alternating rectilinear motion to a heavy frame. For this purpose I have two eccentric wheels working in the same nut, and by the *force of their axles* they propel the frame alternately. Mr. Ruthven is not, therefore, the first who has applied this power. I have six pair thus employed.

I am, Sir,

Yours truly,

W. K. Shenston.

Winchester, Nov. 12, 1824.

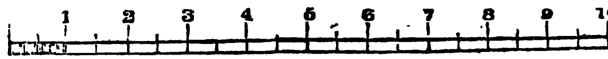
GUNTER'S SCALE.

Sir,—As the construction and application of Gunter's Scale, particularly that part called the line of numbers, for performing the operations of multiplication, division, and extraction of roots, seems to have excited some interest, I shall endeavour to add a little to what has already been said on the subject; for though your Correspondent, "Monad," has given the method of its construction sufficiently clear to those at all acquainted with the nature and application of logarithms, yet he will excuse me, I am sure, in saying that he has omitted that practical illustration of its use that would be of service to the workman; and I was in hopes that he would have followed up the subject by an illustration of their use, particularly when solicited to do so.

The great difficulty in the use of Gunter seems to be in taking from the scale three or more figures; now, in order to thoroughly understand how this is performed, I will first show how, from any plane scale of

equal parts, decimally divided, we are able to do this.

Let a line, as represented below, divided into ten equal parts, as 1, 2, 3, 4, &c. and let one part be supposed divided again into ten equal parts (and all the rest similarly divided), it is plain that each large division will be a unit, or the tenth part of the whole line, and each small division the tenth of a unit; now, if the scale is long enough, each of these *small* divisions may be divided again into ten equal parts, which parts will be the *tenth of the tenth* of a unit, or the hundredth part of a unit.



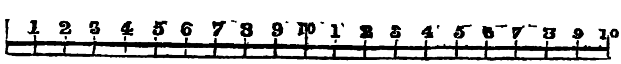
Now if, instead of calling the whole line *ten*, we call it an *hundred*, the large divisions will then be *tens*, the small divisions *units*, and the subdivisions (if the scale is long enough to admit it) *tenths of units*; in the same manner, if the whole line is called a *thousand*, the large divisions will be each a *hundred*, the small divisions *tens*, and the subdivisions *units*.

It is thus plain that the same scale will answer for either one *unit* with three decimals, one *ten* with two decimals, one *hundred* with one decimal, or one *thousand* without any decimal: thus you may take off from the scale (if long enough) all numbers from ·0001 to 1000.

Example.—Suppose it was required to take an extent from the scale, with your compasses, answering to 976.

Here your highest denomination is hundreds; therefore the large divisions stand for *hundreds*, the small ones for *tens*, and the subdivisions *units*. Therefore, setting one leg at the beginning of your scale, open your compasses equal to nine of the large divisions, seven of the small, and eight of the subdivisions, that is, 976, and the same extent will answer to, or express, 97·6, or 9·76, or ·976. It may be here observed, that in the figure drawn above, the small divisions are not drawn throughout the whole length of the scale, as it would cause confusion, and the subdivisions are not marked, as in such a small scale it would have been impossible; but they may be conceived to be drawn and estimated with ease in a scale sufficiently extended.

We will now show how, from this scale of equal parts, we may *add* or *subtract* any number from another, and also find an arithmetical mean between any two numbers; in order to do which, it will be convenient to lay down, on another similar scale, the above line, as in the annexed figure (but too small to show the small divisions or subdivisions), which is analogous to Gunter's line of numbers, which is two scales marked from one to ten, but not of equal divisions; whereas this is marked from one to ten, and repeated, being all equal divisions



Let us illustrate this by an example in each case.

Example 1.—Let it be required to add 749 to 856.

Here we have the greatest denomination, *hundreds*; therefore the great divisions are hundreds, the small ones tens, and the subdivisions units; now find, in the left-hand scale, 8, which is 800, and 5 in the small divisions, which is five tens, or 50; and between that and the next small division, take six of the subdivisions, which is six units, expressing 856. Now this is the point on which to place one leg of the compasses; then, in the same manner, open the compasses to the extent 749, and, with that extent, with one leg at the point 856 (as found), the other leg will reach to 6 in the right-hand scale (which, as we make every large division 100, will be 1000+600, or 1600), and not

quite to the first small division, which is 0; and in the subdivisions the leg of the compasses will coincide on that which is the fifth subdivision from the 6: thus we have 1000+600+0+5, that is, 1605, the correct answer. And thus we may add any two numbers whose sum shall not exceed 2000; and if a third scale had been added, we might have done the same to 3000, and so on.

EXAMPLE 2.—Let it be required to subtract 749 from 856.

Find the point 856, as in the last Example, and take the distance, 749, in your compasses, and you will find, if you extend the other leg towards the beginning of the scale, it will rest between the point 1, which is 100, and not reach the next division, marked the tens, consequently 0 tens, but rest on the subdivision, showing seven units, that is, 100+0+7=107, the answer.

EXAMPLE 3.—Let it be required to find an arithmetical mean (that is, half the sum) between 856 and 749.

Find the sum of the two numbers, as shown in Example 1; then half that distance in the scale, which may be found by trial with the compasses, will be found to be between 8 and 9 in the large divisions, which shows the first figure to be 800, and between the first small division and 0, which shows 0 tens, and between 2 and 3 of the subdivisions, which is two units; but, as it does not exactly agree with that point, we can easily estimate the distance between 2 and 3, where the compasses fall, which is half way; therefore we have the half of an unit or $\frac{1}{2}$ or ·5: thus we have 800+0+2+·5 = 802·5, the correct answer.

Note.—It may be here observed, that as the scales most generally in use are a foot long, the small divisions will be each 100th part of a foot, or a little more than the tenth of an inch, which it will be difficult to divide into ten parts. For the subdivisions this certainly is the case, and for which reason the small divisions are generally divided into two equal parts, and it is left to the operator to judge by the eye, as near as he can, the fifth part of that half, which, by a little practice, may very nearly be estimated; and I would also observe, when the number is large, the unit, in most practical cases, is of no great signification: thus, if the work we have in hand is to be made to the scale of 100 feet to one foot, the thousandth part of a foot, more or less, can, practically, be of little consequence.

(To be concluded in our next.)

REPORT

OF THE COMMITTEE APPOINTED BY THE MANAGERS OF THE FRANKLIN INSTITUTE, PHILADELPHIA, TO INVESTIGATE THE MERITS AND ADVANTAGES TO BE DERIVED FROM THE USE OF JOSHUA SHAW'S IMPROVED MODE OF EXPLODING HEAVY ORDNANCE AND CANNON GENERALLY.

Experience has shown that something like the present has been long a desideratum with military men, and numerous attempts have been made to obtain it; a minute history of which is unnecessary here. During the late war, the United States' Government caused many experiments to be made in various ways, and considerable improvements were introduced into the science; notwithstanding, there has been ample scope left for ingenuity to exercise herself. Her store of knowledge has never yet been exhausted, but seems to increase in proportion to her practice and her experience, and will probably continue to do so, as long as the civilization of man and good government shall remain amongst us.

This improvement is simple, both in respect to the primer itself, and the part with which it is connected; dispensing with the match or portlight, the piercing of the cartridge, occupying of the touch-hole with powder, priming tubes, &c.; and the lock, if it can be called one, is constituted of but two members, simple in their form, certain in effect, and entirely without friction. With respect to the primer itself, we are requested by Mr. Shaw to refrain from any particular description of it until he should have secured it by patent, or the Board at Washington may come to some resolution respecting it.

In appearance it resembles a small piece of metal, about the size and very little thicker than a five cent piece, which is placed over the touch-hole of the gun, and exploded by the falling of a strong spring, which is set at liberty by the shifting of a prop or button, both of which are attached to the cannon.

The advantages of this primer, and the mode of applying it, place it at an immense distance in advance of every im-

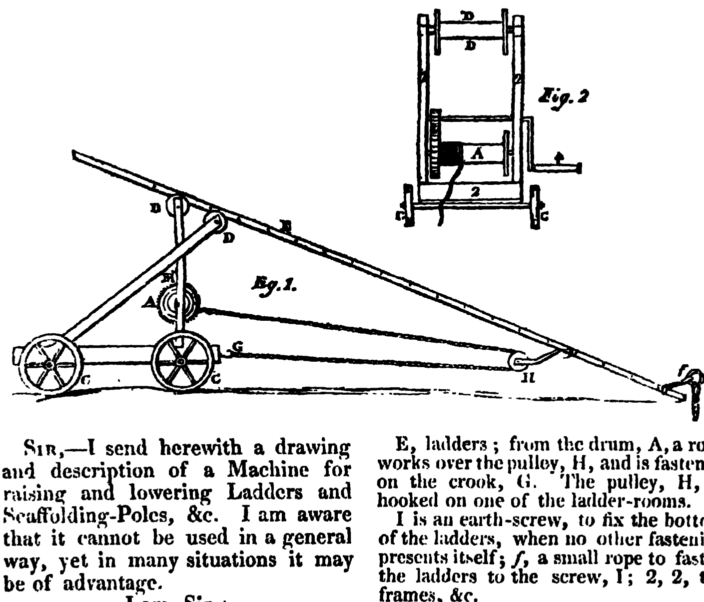
provement hitherto made in this department of science; and having examined it in every point of view, we are of opinion, and from the simplicity of the whole together, it would appear impossible that it should fail to answer the purpose for which it is intended, or even liable to get out of order; and we strongly recommend it to the serious attention of the nation, on the following considerations:—

First, that it is cheaper; secondly, that it is more certain in its effects; thirdly, it is calculated to prevent many accidents to which ships are liable in action; fourthly, one hundred thousand only occupy one square foot of stowage, and are less liable to injury by transportation than many of the means hitherto employed; fifthly, the gun may be fired with facility in rainy weather without much risk of disappointment, and also the manual labour at the gun is much reduced.

D. H. Mason.
Isaiah Lukens.
John S. Phillips.

July 1, 1824.

MACHINE FOR RAISING AND LOWERING LADDERS, SCAFFOLDING-POLES, ETC.



Sir,—I send herewith a drawing and description of a Machine for raising and lowering Ladders and Scaffolding-Poles, &c. I am aware that it cannot be used in a general way, yet in many situations it may be of advantage.

I am, Sir,
Your obedient servant,
R. M'Vey.

Richmond, Sept. 3, 1824.

Description.

Fig 1 is a side elevation of the machine, with ladders, E, on it, ready for raising.

A is a drum for the rope F to work on, with a wheel on its axle for the wheel, B, to work on, turned by the handle, 4, fig. 2.

CCCC, wheels for the ready conveyance of the machine.

DD, two rollers for the ladders to lay on, with guards on each end.

E, ladders; from the drum, A, a rope works over the pulley, H, and is fastened on the crook, G. The pulley, H, is hooked on one of the ladder-rooms.

I is an earth-screw, to fix the bottom of the ladders, when no other fastening presents itself; *f*, a small rope to fasten the ladders to the screw, I; 2, 2, the frames, &c.

Fig. 2 exhibits an end elevation of the machine.

N.B.—On the back rails, K, steps may be fixed, in order to assist the apparatus.

TO CORRESPONDENTS.

** Absence from town obliges us to defer our acknowledgments for the favours of the week until our next.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.
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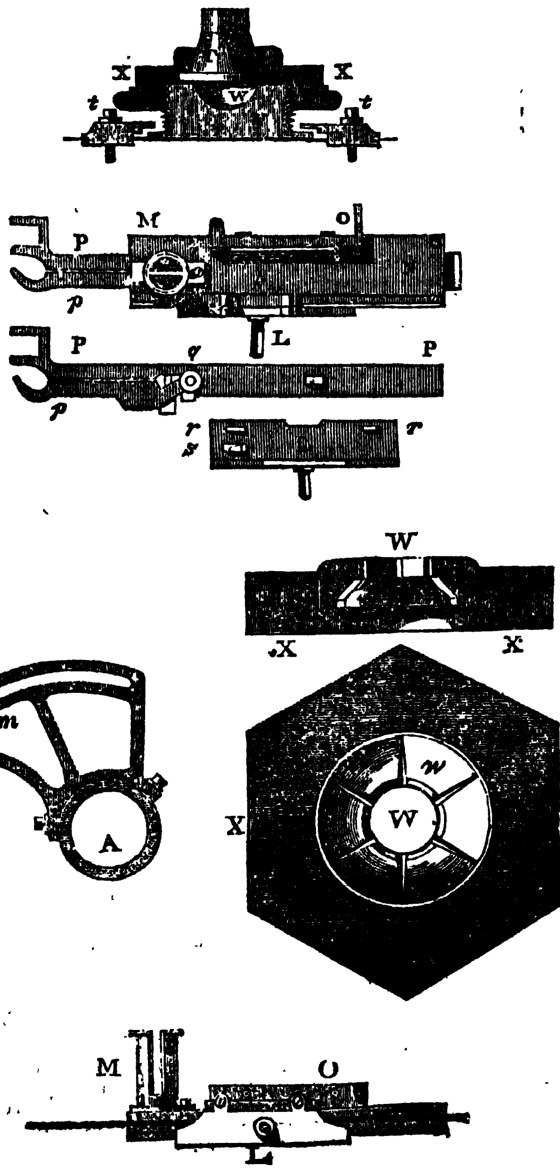
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 67.] SATURDAY, DECEMBER 4, 1824. [Price 3d.

PROCESS OF COINING AT THE ROYAL MINT.

Concluded from our last Number.)



PROCESS OF COINING AT THE ROYAL MINT.

It now only remains to show how the Coining Press is made to remove every piece of money which it strikes, and to feed itself with a fresh blank piece.

HIK, fig. 1, in our last, is a lever, of which I is the fulcrum; it is supported on a bar, Q, fixed vertically from the cheek of the press, and steadied by a brace. The upper end of the lever is actuated by a sector, (see the fifth figure in our present Number), which is fixed upon the screw, D. When the screw turns round, the groove in the sector being of a spiral curve, will move the end, H, of the lever, to and from the screw; and the lower end, K, of the lever being longer, it moves a considerable distance to and from the centre of the press. A socket or groove in a piece of metal is fixed to the perpendicular bar, Q, and the upper end of the lever, H, is guided in this groove to prevent any lateral deviation.

The lever, K, gives motion to a slider, L, fig. 8, which is supported in a socket, O, screwed against the inside check of the press; and the slider, 8, is directed exactly to the centre of the press, and on the lever of the upper surface of the die.

Figures 2, 3, 4, and 8, represent four views of the slider and socket; NMO is a kind of trough or socket in which the slider runs: this slider is formed of two pieces hollowed out on the sides, which are put together, and the two pieces are held together by screws. O is the part by which the socket is fastened to the press. The slider is a thin steel plate, *p*; and this is made in two pieces, P and *p*, which are united by the joint *q*. The extreme end is made with a circular cavity; and when the two limbs shut together, as represented, they will grasp a piece of money between them, and hold it by the edge; but if the limbs are separated, the piece will drop out. The limb, *p*, of the slider, is opened or shut by the same movement which moves the slider endways in its socket. Thus a plate, L, is applied flat beneath the socket, MN, and has an edge turning up and applying to the upright edge of the socket. A pin is fixed into this edge, and is embraced by the fork at the lower end of the lever, K, fig. 1, in last Number. By this means the sliding piece, L, is made to move on the outside of the socket, N. It is kept in its place by a fillet, *k*, fig. 2, which is screwed to the upright edge of L, and the fillet enters a groove formed along the upper surface of the socket, N.

The sliding piece, L, is made to move the steel slider within the socket by means of three studs, which project upwards from the bottom plate of L, fig. 4, at *r r s*, and pass through grooves in the bottom plate of the slider, so as to act upon the steel slider, P, in the manner shown in fig. 3. The left-hand piece, *r*, is received into an opening in the middle of the slider, P, fig. 3. The other two studs, *r* and *s*, include the shank of the limb, *p*, between them, and these studs are cut inclined, so that, when the piece, L, is moved to the right, the studs, *rs*, will close the limb, *p*, until they are shut, and then the studs will carry the slider forward; but, if the sliding piece, L, is moved to the left, its studs will first close the limbs, and will then draw back the slider on the top of the socket, N; a tube, M, is placed, figs. 2 and 8, and it is filled with blank pieces of coin; the tube is open at bottom to the slider, and the pieces rest upon it. When the screw of the press is screwed down, the slider, P, draws back to its farthest extent, and the circle formed at the end between its limbs comes exactly beneath the tube, M; the limbs being open, a blank piece of coin drops down into the circle of the slider; then the screw of the press, in returning, moves the lever, HIK, and the piece, L; this acts by its studs upon the moveable limb, *p*, and closes it upon the blank piece; the studs having now found a reaction, push the slider, P, forwards in its socket, and carry the piece forward upon the die, as shown in fig. 1, Number 66, and which will push off the piece last struck. The screw having now arrived at its highest position, begins to descend, and the slider, L, to return; but the first action of the studs of the sliding piece, L, is to open the limb, *p*, and then the slider withdraws, leaving the piece of money placed upon the die. As the screw of the press descends, the ring, *w* (see our last Number) rises up to enclose the piece, as before mentioned, whilst it receives the stroke, and the slider, P, at the same time returns to take another piece from the tube, M, in the same manner as before described.

Fig. 1 is a section, to show the manner of mounting the lower die for a coining press. This is used in the French Mint. V is a piece of metal or box, as it is placed upon the base of the press, and held down by a ring with screws, *t*; this holds it fast, but admits of lateral adjustment. In the top of the box is a hemispherical cavity to receive the hemisphere, W; the upper side is flat, and the die, T, is placed upon it, to hold the die down; it has a small projecting rim at the lower edge, and a rim, X, is screwed upon the outer edge of the box, V, to hold the die down. The object of this plan is, that the die may always bear fairly to the money which is to strike.

Figures 6 and 7 represent a divided collar, invented by Mr. Droz, for striking money with the letters round the edge. X is a very strong piece of iron, which has a

circular opening through the centre; into this six segments, *w,w*, are fitted, and between them they leave an opening, W, the size of the piece of money; the interior edges of these segments are engraved with the pattern or device which it is required to impress upon the edge of the piece. The segments are fitted in the piece, X, by centre pins, upon one of which pins each segment can rise in the manner of a centre.

The intention of this is to have a piece of money placed on the die within the space, W; then, when the pressure is made upon the piece, the die descends some space, and by this motion the segments close together around the edge-piece, and imprint upon the edge of it. When all the segments come into one plane, the die arrives at a firm seat, and the metal receives the stroke which makes the impressions on its surfaces. The die is suspended in a sort of cup, which rises and falls with the screw, nearly the same as the collar, F, in fig. 1 (last number).

The money, when struck, is passed through tubes of the diameter of the different species, which readily detects any pieces which may have been improperly struck.

BROWN'S ENGINE.

Sir,—In answer to your Correspondent A. F. S. of the Commercial-road, I beg to inform him that there has not been one of Mr. Brown's Gas Engines tried upon the piston principle yet; but there will be in the course of thirteen or fourteen days, as Mr. George Frasi, the engineer, who is manufacturing one, informs me.

I am, Sir, &c.

A Burnt Retort.

P. S.—I think Messrs. Martineau and Taylor's gas apparatus would be of great service to Mr. Brown's engine, for making gas in a small compass.

Sir,—Your Correspondent "D. Screw", may be so far in the right as regards my remark on Brown's Gas Engine, (page 31, vol. III.) but he has not shown that Messrs. Sterling and Brown's machines are different in principle—*this he certainly ought to have done before he had stated that I was erroneous.* Erroneous in what? If he will take the trouble to compare my statement with his, he will perceive that I have not been in an error.

The principle upon which this engine acts (Mr. Sterling's), "is by the alternate expansion and condensation of the *same air;*" but D. Screw will observe that no mechanical art is used for this condensation; it is merely the heated air rushing into a colder apartment, and, by this means, collapsing itself. Now, the mechanism of Mr. Sterling's engine would be rendered equally effective without such a cylinder, simply by substituting a valve or valves to admit the external air. Where, then, I would ask, exists the difference between Sterling and Brown's machines? You admit (page 388, vol. II.) "that the mechanical parts of these engines may be continually varied; *but the construction by which the vacuum is effected, and for which the patent is obtained,* MUST ALWAYS FORM THE MOVING POWER;" and, pray, what is that? Why, the rarefaction of air by heat. Your Correspondent, therefore, need not attempt to *screw* into my cranium any principles repugnant to those which I have already placed there; and although I am no dogmatist, yet I think it will require all his power to *wrench* them from me.

I am, Sir, yours, &c.

J. Y.

STEAM NAVIGATION.

Sir,—The interest excited by the Steam-Boat question has tempted me to offer another solution; and if those whose mathematical knowledge may enable them to reason without doubt on the subject do not think it correct, perhaps they will kindly show the light of their information to one who is earnestly endeavouring to find his way in the dark.

Suppose the velocity of the wind required to propel the boat six miles per hour be twenty miles per hour, then $20 - 6 = 14 =$ the relative velocity, or that with which the wind acts on the sails of the craft that already moves six knots per hour by the

steam. The *force* of the steam or of the wind acting separately is similar, because the effect is the same, viz.—that of moving the vessel six knots (per question); but the force with which the wind acts for any given time is as its velocity in the same time squared; in this case, if the wind act alone, it is therefore as $\overline{20}^2$; also the force of the steam, as before mentioned, being similar, that force to move the vessel six miles per hour is likewise as $\overline{20}^2$, and the force with which the wind acts on the boat already in motion by the steam is as the relative velocity squared, that is, as $\overline{14}^2$.

Hence $\overline{20}^2 : 6 :: 14^2 : x$ (2.94).

In words—If a force proportional to $\overline{20}^2$ move the boat six knots per hour, at what rate would a force proportional to $\overline{14}^2$ move her? The fourth term or answer, however, is too much, and requires a correction, because the wind will not act with so great force when it has impelled the boat (by its first impulse) faster than six knots. It is likewise evident the succeeding impulses will be weaker as it recedes from the preceding ones; therefore I take, as an approximation not far from the truth, the square root of the fourth term for the additional velocity communicated to the boat by the wind. The answer will then be $6 + \sqrt{2.94}$ = $6 + 1.716$, or 7.716 less than seven miles and three quarters per hour.

It will be seen that I have taken the velocity of the wind at twenty; a few miles either way will make but little difference, which may be readily seen by any one who chooses to try 25 or 30 with the analogy.

I am, Sir,

Your humble servant,

PADDLEWHEEL WIND-AND-STEAM.

GUNTER'S SCALE.

(*Concluded from our last.*)

Being thus prepared, I will now endeavour to show the use of Gunter, and beg the reader to remember, that by the help of artificial numbers, called logarithms, we may perform the operation of multiplication and division by means of addition and subtraction; and by taking the half of any logarithm, we find another logarithm, which answers to the square root of the number expressed by the first logarithm, and divided into three parts, the cube root, &c.

Construction of Gunter's Line of Numbers.

Take any convenient scale (suppose one foot), and set the distance on your Gunter equal unity. Now this is to be divided into ten parts, to correspond to the logarithms of $\frac{1}{10}$, $\frac{2}{10}$, $\frac{3}{10}$, &c. Now the logarithm of $\frac{1}{10}$ is equal to 0; therefore the first division corresponds to the beginning of the scale (we have here nothing to do with the indices of the logarithms, which only denote whether the numbers be whole or fractional). Now find the logarithm of $\frac{2}{10}$, which is 301; take this from your scale (supposing it divided into 1000 equal parts), and apply it to your Gunter, and you have the point marked 2. Again, the logarithm of $\frac{3}{10}$ is 477; take from your scale 477, and apply it to your Gunter, you have the point 3; and in this manner proceed for all the large divisions: and in the same manner lay down your small divisions to correspond to the logarithms of $\frac{1}{100}$, $\frac{2}{100}$, $\frac{3}{100}$, &c. (and if your scale will admit of it, you may find your subdivision in the same manner); thus you will have a scale expressing the logarithms of all numbers from ·001 to unity, if your whole scale is unity; or of ·01 to 10, if your scale is 10; or from ·1 to 100, if your scale is 100; and, lastly, if your scale is 1000, you will have the logarithms of all numbers from unity to 1000: and hence, adding any two or more of these divisions together is the same thing as multiplying the numbers they represent on the scale, and subtracting any one from another is the same as dividing the numbers they represent on the scale, &c. Now, owing to the smallness of the divisions (even when your scale is a foot long), those small divisions, as you approach the end of your scale, cannot be divided into more

than ten equal parts. To be seen distinctly, the general practice on Gunter's scale is, from the commencement of the scale to the point 2, to divide it into ten parts or small divisions; and again, each part to be subdivided into five parts for the subdivisions, from the 2 to the 5, each small division into two parts, and from 5 upwards cannot be divided into more than ten parts to be distinct; hence, in the use of the scale, when the compasses do not fall exactly on any division, you must estimate, as near as you can, the subdivisions.

Note.—For those mechanics who would wish to construct a Gunter scale for themselves, I would recommend the inspection of some tables in Fergusson's Select Exercises, page 191 and following; and where they will also find full directions for the construction of the plane scale, sector, and Gunter's scale, at page 206 and following.

Use of Gunter's Line of Numbers.

Before giving some examples, I must premise, that in all the best scales, the numbers from 1 to 10 are repeated twice, and form two equal and similar scales; and that when two or more figures are used, the compasses will often extend beyond the second scale; therefore there is part of a third similar scale, if not the whole, added, which generally extends to the number 2 or 3 only; but if your rule is long enough, the whole of a third scale is very useful, particularly for the extraction of the cube root.

To illustrate the application, I shall give the solution of the examples proposed by your Correspondents J. L., G. P., and H. S. And first,

To multiply 46 *by* 54.

Place one leg of your compasses at the beginning of your scale, and extend the other to 46, that is, to four of the large divisions, and six of the next small ones; then, with that extent, place one leg on 54, that is, at five of the large divisions, and four of the next following small ones, and the other will extend to two of the large divisions on the second scale, and four of the next following small ones, and a little more than the half of a division, which we will estimate as 80 subdivisions; that is, 2000+400+80=2480, which is within four units of the truth, and, as before observed, in general sufficiently exact for most practical purposes; but if the scale had been large enough to show the subdivisions, it is clear we should have had the true result.

To divide 2484 *by* 46.

Calling 2 in the second or right hand scale 2000, and each of the small divisions 100, set your compasses, with the distance 46 from the first scale, on the estimated point 2484, as near as you can guess; you will find the other leg, extended backwards to the first scale, will pitch on the point shown at 5 of the large divisions and 4 of the smaller ones, which is five tens, or 50, and four units, that is, 50+4=54, the true answer.

To extract the Square Root of 324.

Calling the large divisions of the first scale hundreds, extend the compasses to three of the large divisions, two of the small ones, and estimate four subdivisions, that is, 300+20+4=324; lay this distance down, for convenience, on a line drawn on paper, and divide it into two equal parts; take one of these parts in your compasses, and placing it at the scale, you will find it extend to 18 small divisions, that is, 18 units, the answer required.

I am afraid I have extended this article to too great a length, and shall be thought prolix; but my aim has been to explain the use of the scale in a familiar manner to the workman; and though it may lay me under the censure of many versed in mathematical knowledge, it will, I am sure, be excused by those who look to the motives which induced me to be thus minute, which is, that *practical* mathematics may be extended as much as possible among the working classes. If this plan is persevered in, it will, I am confident, be of incalculable benefit to society in general.

I am, Sir,
Your obedient servant,
G. A. S.

MINUS.

Sir,—I have lately been not a little amused and pleased with the difficulties of your Correspondent "Piger," and the learned lucubrations of his explicators: to me (not much of an algebraist) the case appears to lie in a nut-shell, and easily solvable, as follows. If I am wrong, I should be very much obliged by some of your more able Correspondents pointing out the "why and the wherefore."

It is, I believe, a generally admitted principle, that *two negatives* make a *positive*; and if the question be tried by this simple rule, I think it cannot fail of bringing conviction home to the commonest understanding.

Negativing a *negative* is making that negative a *positive* If I say to a man, "You are 100*l*. worse than nothing," or "your affairs are $-$ 100*l*") he may say to me, "I can *negative* (or reverse) your assertion three times (or $-$ 3), which he effectually does by producing his books, and proving that he is worth 300*l* (or + 300*l*.) The reason of this i obvious, as all terms *must be* either negative or positive; and as the one is the *reverse* of the other, it follows that, if I set out at first with a negative, and then bring *another* negative to act upon it, I reverse it, and make it an *affirmative*: in fact, I *deny* that it *is* a negative, and, if it is not a negative, it must be an affirmative. Thus $-$ *a* multiplied by any number of positive terms must still be minus; but, if once it gets counteracted by another negative, it turns round, and becomes a positive term.

I am, Sir,
Your obedient servant,
G. S. W. C.

IMPROVEMENTS OF LONDON.

Sir,—I observe, with pleasure, that you devote occasionally a corner of your valuable and justly popular publication to suggestions for the improvement of the metropolis. It must be truly gratifying to every inhabitant and visitor of London to see what has recently been accomplished in that respect, especially in the neighbourhood of Palace Yard and the new street (bad as it is in detail) leading from Pall-Mall to that beautiful and noble spot, the Regent's Park. Waterloo Bridge is above all praise; and the intended Quay along the bank of the Thames, if properly conducted, will, indeed, be another vast and important embellishment; and it is to be hoped the projectors will, in this respect, take for their model the beautiful terrace called the Boom Quay, at Rotterdam. It must be noticed that the Waterloo Bridge and this intended Quay are the result of individual subscription and enterprise, with which Government has nothing to do, though it must, at the same time, be acknowledged that, amongst the leading Members of Administration, as well as in Parliament, there is a great spirit and desire of improvement and good taste.

I join in the hope expressed in the letter of "Julius," in your 65th Number, that the front view of St. Martin's Church may be thrown open to the end of Pall-Mall, and that the Custom-House may receive, what every one laments the want of —a fine portico in the middle of the building, as well as additional grandeur in other respects. But, Sir, there is still an opportunity for Parliament and Government to keep pace with individual subscription and exertion, and that is, by opening a grand and spacious street from opposite Waterloo Bridge to the end of Tottenham Court Road, taking in the line the front of Covent Garden Theatre and St. Giles's Church; this would be a grand communication and approach to Oxford Street, which is much wanted from the neighbourhood of Covent Garden. Near the Strand end of this new street might be erected an exact copy of the Pantheon at Rome, which would, indeed, be a truly metropolitan ornament; we should then have a building worthy of this great city, and a *fac simile* of the finest proportions that either ancient or modern architecture can furnish, if it be but made an exact copy of the original, with-

out the paltry modern turrets which at present disfigure the finest portico in the world. No spot can be more proper for such an erection, except, indeed, the site of the Golden Cross, at Charing Cross, from which point it would have a grand and very picturesque effect. The interior of this building might well be appropriated for the annual exhibition of the Royal Academy; and I am certain, Sir, that the expense would be defrayed by a public subscription, aided, perhaps, by a grant from Parliament. The public would then have something, indeed, worthy their notice and admiration, and would be saved the labour of winding up the tedious staircase of Somerset House, to a suite of apartments badly adapted to the seat of the Fine Arts in England.

I am, Sir, yours, &c.

A.

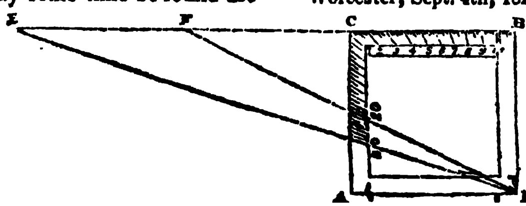
SHORT METHOD OF MEASURING HEIGHTS.

Sir,—I beg leave to send you the description of a simple instrument, of my own construction, for ascertaining Heights without calculation, which may some time be found useful, particularly in measuring standing timber.

I am, Sir, yours, &c.

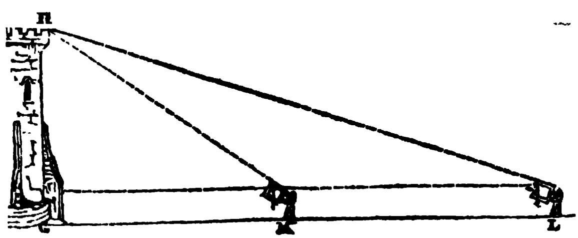
Samuel Mainley.

Worcester, Sept. 4th, 1824.



Description.

Construct a square (A B C D, fig. 1st,) of any given size; divide the side (B C) into ten equal parts, and number them from B to C; subdivide each of these inot ten, and continue these equal divisions on the straight line (B C E F) to any distance; but to twice the length of B C, as at F, will be found quite sufficient. Draw straight lines from all the divisions in B F to the point A, as F A, E A, C A, &c.: cut out the square (A B C D), and paste it on a board or frame; place two sights on the side (A D), and let a plummet be suspended by a fine thread from the point (A), and the instrument (ABCD) is complete.



To find the height of an object having the base (K G) given (fig. 2nd).

Look through the sights (D A) at the object (H), and the plummet-line will show its height, in decimals, to the hundredth part of the base (K G). For example: suppose the base (K G) to be 65 feet, and, looking through the sights at the object (H), the line stands at 83; then 65 × .83 = 53.95 feet, the height of the object. It would, however, be most convenient to let the base (K G) be 10 or 100 feet, yards, &c.; then the plumb-line will show the height at once, without even multiplication, but to which, of course, the height of the eye must be added.

And, by a little calculation, the height and distance of an object may be found, the base of which is inacces-

sible: thus, if at K the plumb-line stand at .73, and, by moving 40 yards in a direct line from the object to L, the plumb-line cut .47, what are the height and distance?

Let $x=(gh)$ and $y=kg$,

then $.73y=x$, and also $\overline{y+40}\times .47=x$;

therefore $.73y=.47y+18.80$, and y the base$=72.3$ yards,

and x the height$=52.78$ yards.

READ'S VITRIFIED PIPES.

Sir,—My attention has this day been arrested by a letter in No. 51 of your Magazine, from a "Lover of Useful Inventions," who, in allusion to Mr. John Read's Patent Vitrified Pipes (baked pipes, as he is pleased to call them), for raising water, asserts that they *by no means answer the intended purpose*. That such an assertion should be made in the face of a great number of facts to the contrary, and at a time when every expectation of the utility of these pipes is fully realized, and the merits of the invention substantiated, by an extensive application of them for drawing water from wells in various parts of the country, is somewhat extraordinary, and discovers a feeling not very creditable to a promoter of inventions and the arts. Having some knowledge of the utility of Mr. Read's pipes, and knowing that he is himself at this time engaged in some part of Sussex in laying them down, I feel myself called upon to vindicate their merits as far as in my power. As an antidote to the gross misrepresentations in the letter I allude to, I shall briefly state one or two facts that are within my own knowledge, and of which any other person may satisfy himself. Mr. Perigo, sen. of Hawkhurst, Kent, had a pump constructed of the patent earthen pipes, in 1816, which has continued in perfect condition and action ever since, with the exception of a very slight repair after the severe frost in the year 1822. In this instance the pipes were laid at the depth of fifty feet. Mr. William Noakes, of Ticehurst, Sussex, had a lead-pump taken up from a well on his premises, fifty feet deep, and replaced it with the patent earthen pipes for less than one-third of the expense of the lead-pump. This was done in 1819 or 1820, and the pump has continued to act well ever since. The truth of this may be known by applying to Mr. Noakes, hop-factor, in the Borough, Southwark.

It is true that some defects were discovered in the early stages of Mr. Read's experiments (and what invention, which requires perfection in every part, has not been attended by some crosses or other?); but even these may have arisen more from collateral circumstances than from the intrinsic qualities of the pipes themselves—such as in stiff clay soils, from injury being done to the pipes by the contraction of the earth, and, in some instances, by severe frost, which will, at times, even burst leaden pipes; but even such difficulties as these have, by practice and experience, been entirely obviated.

I am, Sir,

Your humble servant,

R. Stanynought.

Newington, Surrey,
Nov. 24, 1824.

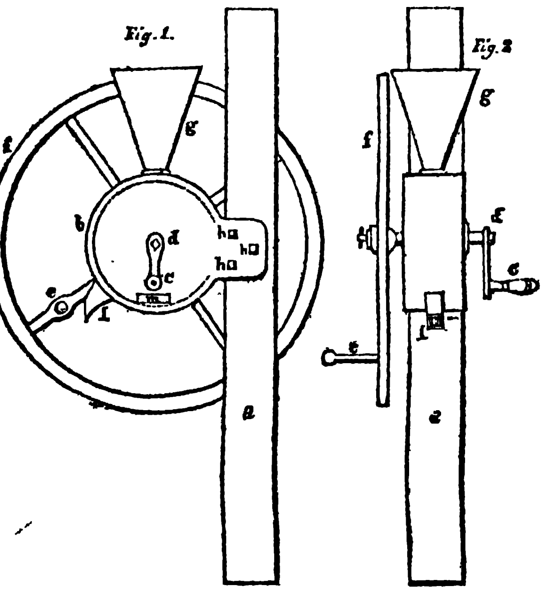
METHOD OF PREPARING SODA WATER.

Soda Water is prepared (from powders) precisely in the same manner as ginger beer, except that, instead of the two powders there mentioned, the two following are used:—For one glass, 30 grains of carbonate of soda; for the other glass, 25 grains of tartaric (or citric) acid.

INSTANTANEOUS PRODUCTION OF CURDS AND WHEY FROM MILK.

A very ready and elegant mode of procuring curds, and also a pleasant acidulous whey, is, by adding to a glassful of milk a little solution of citric acid, taking care not to add too much: an experiment or two will readily show the quantity necessary to effect the purpose.

PORTABLE HAND-MILL



SIR,—A Correspondent asks (vol. II. page 383) for a "Plan and Description of a Portable Hand-Mill." I beg leave to forward one, which is very simple in its construction, and not likely to be injured in travelling. I have had an opportunity of seeing it used with success for several years without its requiring any repair. Your Correspondent desires that it might take up but little room; this, however, is hardly to be expected without a considerable augmentation of labour in grinding, as the only part that could be dispensed with is the wheel, instead of which a second handle might be substituted, precisely similar to that marked *c*.

Description.

Fig. 1 represents a side elevation; fig. 2, a front elevation of the mill; *a* is an upright, to which the body, *b*, of the mill is fixed by means of the screw bolts *hhh*; *c*, a handle attached to the spindle *d*, which passes through the body of the mill; *e*, another handle fixed to the wheel, *f*, which revolves on the extremity of the spindle, and serves to facilitate the turning of the mill; *g*, the hopper; l, the valve; *m*, a small door, for the purpose of occasionally removing the bran which may accumulate in the interior. It will take entirely to pieces, and occupies no very considerable space.

The one from which this drawing was taken, was purchased in London, a few years since, at a trifling expense; but, as I have forgotten the name of the maker, I can give no information to your Correspondent on that head.

I am, Sir,
Your obedient servant,
W. H—s.

Chatham, Aug. 22, 1824.

WATCH KEYS.

SIR,—It will afford satisfaction to myself and others, if any of your ingenious Correspondents can suggest a good reason for the alteration that was introduced about twenty-five or thirty years ago in the construction of Watch Keys. So complete, indeed, has the change been, that it is now nearly impossible to find, in any shop, a key on the old mechanical principle, which yet, in my humble opinion, was admirably

adapted to its purpose, and much superior, both in convenience and equability of winding, to the modern or straight key, in the employment of which the motion is necessarily intermitted and *jerking*. If it be attributed merely to the caprice of fashion, I should say, that however allowable it may be to sacrifice to that idol in things indifferent, in those of pure utility we should endeavour, in the first place, to ascertain the best inventions, and then resolve to adhere to them until they shall be superseded by obvious improvements.

I am, Sir, the well-wisher of your instructive publication,

SENEX.

NEW VOLTAIC MECHANIC POWER.
(FURTHER DEVELOPMENTS.)

From the Chemist.

That the powerful agent, Voltaic electricity, is speedily destined to pass from the laboratory to the workshop, is not disputed by any person with whom we have conversed, or from whom we have heard on the subject. It is admitted to be applicable as a mechanic power; but the suggestion is so novel, that no experiments have yet been instituted to ascertain its advantages. All the mighty effects in nature of what is called electricity are not known to us; but that it is the active agent in most of the changes of the atmosphere, and in producing many other important phenomena, is clearly established; and by borrowing it, therefore, we may expect in time almost to equal, by our labours, some of the minor but stupendous works of Nature. It was an observation of that illustrious man, Lord Chancellor Bacon, "That man can only subdue Nature by obeying her laws;" and in the same manner we may say, that man can only hope to equal her operations by working with her instruments. The connexion betwixt common electricity and *Voltaic* electricity is clearly demonstrable, and the connexion between, or rather the identity of, common electricity and lightning has been long known and admitted. Thus we have, in the Voltaic battery, manifested indeed by some unexplained causes, but manifested in such a manner as to be perfectly at our command, the same agent which hurls lightning through the sky, and which is so terrific, that, till science explained its origin, it was considered as an indication of the ire of an avenging deity. It is this agent which we stated in our last Numbe, might be introduced into use as a mechanic moving power, and of which we then promised some further developments.

The objections stated to our proposal amount in substance to two. The first is, that the expense of generating a sufficiency of the two gases will be so great, in proportion to the quantity obtained, that it can never be so economic a power as steam. The value of this objection amounts to this: coals are now comparatively cheap in England, and copper, zinc, and sulphuric acid, comparatively dear. But there are countries and situations in which fuel is scarce and dear; and in such it may be advisable to think at least of a Voltaic mechanic engine. But those who make this objection are quite in the dark as to the quantity of the gases generated by a Voltaic battery; no experiments, in fact, have ever been made to ascertain what quantity of gases are produced with a given Voltaic battery within a given time. This is a point we mean to ascertain, but have not yet been able. We may observe, however, that the quantity we may produce will always depend on the size of the instrument and extent of the metallic surface exposed to the action of the acid; and if we choose to add to the number and size of the plates, we may decompose an indefinite quantity of water.

The expense of a Voltaic battery, according to the charges of the philosophical and mathematical instrument-makers about town, is, for each trough complete, containing ten pair of plates, of four inches square, the size of those at the Royal Institution, on Dr. Wollaston's plan, 2*l.* 4*s.*; making the expense of a battery of 400 pair of plates 88*l.* By the ordinary method of connecting the plates, such a formidable battery will cost, for each trough of ten pair, 1*l.* 14*s.*; making, for the whole, 68*l.* With the ordinary wear of such a battery, it is calculated that it will last two years. Let us suppose that ours will be more frequently in action, and will last one year; then the capital required for such a battery will be only 88*l.* per year. The troughs also do not wear out like the metals, and therefore want no renewing. They cost 10*s.* each. The acid employed costs about 3*d.* per lb. buying it from the dealers in London. The proportion recommended by Mr. Brande is 1 lb. of acid to 60 lbs. of water; and supposing it takes 20 lbs. of this liquid for each trough (consequently one-third of a pound of acid), and that the acid requires to be renewed once every day, we shall have for the daily expense of the acid 3*s.* 4*d.* The labour of managing this part of the business will be a mere trifle; and as the mode of operating will produce almost a perfect vacuum, we say, that for the daily expense of 3*s.* 4*d.* and a capital advanced of somewhat less than 100*l.*,

we may get a very considerable power: the cost of its application is another thing, and must be decided by other principles.

In this estimate of the expense of a Voltaic battery, it must be recollected that we have taken the price which philosophical instrument-makers, who are men of talent and ingenuity, and are paid accordingly, charge for these things; and that the article they supply is finished with great neatness and care. For Voltaic batteries to produce a mechanic power, we should go the cheapest and mo t economical way possible to work. Taking this into consideration, we have no hesitation in saying, that whenever Voltaic batteries should be articles of regular manufacture, and there were a considerable demand for them, that their price would be reduced more than one-half. In our opinion, it is a considerable recommendation of the Voltaic mechanic power, that all the materials which go to produce it are, in a great measure, the product of labour, and will get cheap as that labour is more efficient. Another thing also which requires to be observed, is, that the copper and zinc and the acid employed would not be annihilated, and might be recovered; consequently, the expense of supplying these articles would be little more than the expense necessary to recover them after being used. We have, in fact, decomposition and recomposition, both of the water from which we procure the gases, and of the materials by which we decompose that water; and the power we actually employ, or consume, is only that immaterial agent which is made manifest on the decomposition and recomposition, and which, as it is measureless, is inexhaustible.

Even if it should turn out that galvanic electricity, employed to decompose water, and inflame the gases, is an expensive way of getting power where fuel is cheap, a point, however, which is not ascertained, for nobody has made any experiments concerning it, the suggestion may still be of great utility where fuel is dear, or where it cannot be procured. Even where it is cheap, a Voltaic mechanic power may still have some recommendations. The space into which it may be put is small; it emits no smell, and sends forth no smoke; it will annoy nobody, and never be a nuisance; it does not depend for its operations on the elements; the materials necessary for it are all easy of carriage; and it may thus perhaps serve to equalize the gifts of Nature, and liberate industry and the arts from the fetters of local restriction.

The other objection, which applies to working explosive engines, which a Voltaic mechanic engine will be, shall be considered in our next.

IRISH POLISH.

Sir,—From page 63, Number 60, of your Magazine, I find that a statement of mine was misprinted in page 272 of vol. II. Your "Constant Reader," in his third question, asks, With what is *it* (viz. the polish) to be "*washed* off?" My receipt ought to have been printed, "well *wiped* off," and with the finest old linen that can be had, till dry.

This is not *French* polish, but old *Irish*. It applies to new furniture in particular, for, if any thing else has been used before, *it* must be taken off before this process is commenced. Ink may be spilt upon it, when it is complete, without staining. I think all inquiries are answered, when I state that there is not any thing to be done before you put on the mixture, but to have the wood very well cleaned; because, after that is put on, it will *exhibit* the *state* of the wood, whatever it may be, and there is then no remedy but to scrape all off and begin again. When the polish is complete and hard, if the wood should be marked by the bottom of a cup or glass, that must be well washed off with cold soft water before you put on any of the mixture, otherwise a few coats of the varnish will only keep that mark there, and make it more visible from being polished over.

I am, Sir,
Your constant reader,
JOSIAS MURRAY.

Dublin, Nov. 21, 1824.

THE STEAM-GUN FOLLY.

The letter of the "Gun-Sponger," given in our last Number but one, showed very clearly the erroneousness of the statements which have been recently put forth by Mr. Perkins and his friends respecting the superior powers of steam, as compared with gunpowder, in propelling shot. It now turns out that the invention is not only useless, but has been repeatedly tried before, and failed. General Chasseloup proposed the employment of steam guns for the defence of places in 1805; and Mr. Watt, as stated by Veritas, vol. II. p. 234, tried the ex-

periment long before. It is also a fact, that Hornblower, thirty years ago, constructed a steam-rocket, though this is not generally known. General Chasseloup, however, seems only to have had a notion of such a thing, and to have formed no definite plan on the subject. In 1814, M. Gerard, an officer of Engineers, constructed a weapon of this kind. The boiler was moved on a carriage, and supplied steam for six gun-barrels, *the breeches* of which *could be opened at pleasure*. On turning a handle, the six barrels received a ball and the steam at once. The longest shots were made by turning the handle slowly, and 180 balls were thrown in a minute Two cassoons attended the machine with fuel and bullets. A certain number of these instruments were made for the defence of Paris, but were destroyed on the Allies entering that city in the above-mentioned year.

The application of steam in this way, even on the high pressure system, is found, on experiment, to be only substituting a *less* for a *more* effective instrument. The following explanatory observations on the subject we extract from *The Chemist*:

"The expansive power of water compared to that of gunpowder is, perhaps, on the whole, greater; but, in first of all converting it into steam before it is used, the larger part of that expansive force is destroyed. If a drop of water get within a mould in which metal is to be poured, its expansive power is so great as to scatter the whole mass; but, by the application of heat to water, in a certain free space, this power is diminished in proportion to the size of this space. Now, first to heat and then to boil water, is a great loss of this power; and, as Mr. Perkins has not compressed steam so as to make it manageable beyond 500 atmospheres, while the explosive force of gunpowder is more than 1000, it is plain that his invention substitutes a less for a greater power. If, however, the *facility of loading* and discharging the piece, which belongs to the steam-gun, and is its distinguishing excellence, could not be imparted to the powder-gun, the steam might be preferable. This, however, does not seem to be an impracticable problem. With the present perfection of our mechanical instruments, and our skill in casting, it seems not impossible to make powder-guns which shall be loaded at the breech. When this is effected, powder will be assuredly superior to steam. Nor does it seem impossible to make a gun which shall be connected with a reservoir both of powder and balls, and by means of a mechanical contrivance to have a certain quantity of this powder and a single ball propelled into the chamber of the gun, and discharged at any given rate. We take no delight in instruments of destruction; but we recommend those who do, rather to turn their attention to the mechanical improvements of which powder-guns may be susceptible, than to have recourse to steam. The principle of all improvements must be to load the gun at the *breech*."

ALLAN'S DIVIDING ENGINE.

Sir,—The Correspondent who inquires, in No. 65, for Mr. Allan's Dividing Engine, is informed that Mr. Allan is dead, and that his son has since sold it to Mr. Cooke, the optician, of Wapping, but I do not know whether it is in use beyond Mr. Cooke's own trade.

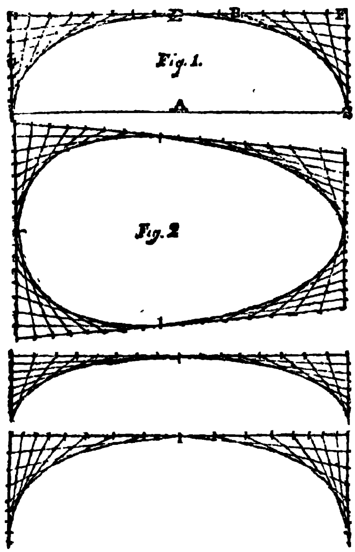
I am, Sir,
Yours respectfully,

Nov. 27, 1824. ÷

PREPARATION OF GINGER BEER POWDERS.

Take two drachms of fine loaf sugar, eight grains of ginger, and 26 grains of carbonate of potash (all in fine powder); mix them intimately in a Wedgwood's-ware mortar. Take also 27 grains of citric or tartaric acid (the first is the pleasantest, but the last the cheapest). The acid is to be kept separate from the mixture. The Beer is prepared from the powders thus:—Take two tumbler glasses, each half filled with water; stir up the compound powder in one of them, and the acid powder in the other; then mix the two liquors. An effervescence takes place—the beer is prepared, and may be drank off. It must be drank off directly, or it will become flat.

FORMING AN OVAL, OR ELLIPSIS.



SIR,—The following method of drawing the Oval or Ellipsis, not generally known amongst mechanics, may prove useful to some of your numerous readers :—

To form a semi-ellipsis, draw the line A, fig. 1, and, at the height of the required arc, the parallel line B, and at the required length of the base the two lines C and D; equally divide the line B, as at E, and the portion of the line B from E to F, into as many equal parts as may be thought sufficient, and divide the line F G to answer to the line E F in number of divisions. Proceed the same with the lines H E and H I, and then draw the crossing lines, commencing at E; carry the line to the first division below F on one side, to the first division below H on the other, and the remaining lines as seen in the figure.

The method of drawing the oval, or egg-shape, will be easily seen by a reference to fig. 2. Any elliptical figure whatever may be drawn by this method, by varying the number and situation of the divisions.

I am, Sir,
Your obedient servant,
R. H.

THE SCREW QUESTION.

SIR,—I am really sorry that I should have given offence to your worthy Correspondent "A." He may rest assured, however, that not one of your Correspondents has a less desire to give offence than Nichol Dixon; and although I may have run rather into an extreme in my remarks on his explanation regarding the Screw-driver, yet I hope he will be liberal enough to forgive me. He ought, however, to have recollected that, before he contradicts the statement of any Correspondent, he ought to keep in view the excellent motto prefixed to No. 31 of the Mechanics' Magazine.

"D. H. In—y" has also been sarcastic enough; but the view he takes of the subject, although correct in some points, is, in my humble opinion, materially wrong in others. "X. Z." however, has not effected his position; and "T." says, that he is perfectly satisfied that the less elasticity the better. There is, unquestionably, a limit to the elastic force of the screw-driver; but I am yet firmly of opinion that, through its agency alone, we can account for that superior ease which every mechanic must have experienced when using a long, instead of a short screw-driver.

I shall, shortly after Yule time, give you my ideas on this subject, which are at perfect variance with those of your other Correspondents; and until then,

I am, Sir,
Your obedient servant,
NICHOL DIXON.

Red Lion-street, Clerkenwell,
Nov. 25, 1824.

TO PREPARE LEMONADE.

Mix one part of citric acid with six parts of finely-pounded loaf sugar: a very fine dry lemonade is thus prepared, which may be preserved for any length of time. The quantity of this mixture necessary to be put into a glass of water, to make a pleasant drink, must be regulated by the taste of the person using it.

SAFETY FOR THE DEAD.

SIR,—A Correspondent, under the head of "Safety for the Dead," recommends the placing a pound of gunpowder in the coffin in some detonating medium; so that, upon the removal of the lid, an explosion may take place, and the persons near it be destroyed.

He writes upon a subject which he does not contemplate *in all its bearings*. Medical students must have subjects, or they must be turned upon the public ignorant of their profession; as it is well known to all surgeons, that neither plates nor models will answer the end proposed.

A body already costs sixteen or eighteen guineas, and were T. P. A.'s plan put in practice, they would be at double the money, from the increased risk. As to preventing the practice, that is impossible under the present system.

In Paris you never hear of a grave robbery, and for this plain reason: the bodies of paupers and unowned persons may be procured for a few shillings (francs) by proper application; and the French surgeons are, in consequence, able anatomists and clever practitioners.

The contrast between them and our half-educated young men was strikingly exemplified in the beginning of the last war. The French soldiers were attended by men who had dissected, and our unfortunate fellows fell often into the hands of those who had *not* dissected: the consequences are obvious. Look at the state of medical science in Turkey and Russia, where dissections are not permitted, and let me ask T. P. A. how he would like to be obliged to submit to an operation, or replacing a dislocated limb, by one of their surgeons? It is a notorious fact, that the wounded Russians immediately surrendered to the French, on purpose to be placed under the care of the French surgeons.

Of two evils, Sir, it is wise to choose the lesser; and unless T. P. A. will induce our legislature to adopt the Parisian plan, it is better that graves should be robbed, than the living mangled, and absolutely murdered, by ignorant surgeons.

I am, Sir, yours, &c.
SAFETY FOR THE LIVING.

Bristol, Nov. 14, 1824.

EXPANSION OF WATER IN FREEZING.

SIR,—It appears from the letter of T. H. Number 63, p. 103, that I have not exactly understood the particular law of the expansion and contraction of water, to which the term *miracle* is applied in the article copied from "*The Chemist*." I apologise to the Chemist for my misapprehension, and I thank T. H. for his correction. I certainly had not read Professor Leslie's Experiments on producing Artificial Cold, or I should not have asserted, in Number 62, p. 93, that water freezes slowly in closed vessels. I fell into the error from having read it as a fact, some few years ago, in a work at that time of some authority. I am, however, not yet convinced that the *mixture of air with ice* is not partly the cause of its floating upon water; for what results from the experiments of the learned Professor? Why this, that the ice produced by water frozen in as complete a vacuum as can be made, is considerably *heavier* than ice produced in the ordinary operation of nature; and, therefore, I will contend, that this fact is very much in favour of my gratuitous assertion, as T. H. is pleased to call it. Perhaps, Sir, I will be compared to the Schoolmaster, in the beautiful poem of Goldsmith, of whom he says—

> "For e'en though vanquish'd, he would argue still."

But I am seeking knowledge, and therefore provoke inquiry, even at the risk of still further exposing my own ignorance; and I would not have any of my brother Correspondents be afraid of *sporting* a random opinion now and then, for the sake of acquiring information. We cannot all be equally wise; but let us follow the advice of Solomon, who says, "Wisdom is the principal thing; therefore get wisdom."

The beneficial consequences on the economy of nature, in the conversion of water into ice, cannot have escaped the most casual observer; at the same time it must be admitted, that some inconveniences are produced by it. The same cause which pulverizes the clayey, stub-

born soil of the farmer, splits and rends his finest oaks; and that frost which mellows our parsnips spoils our potatoes.

I remain, Sir, yours, &c.

GELIDUS.

FRENCH AND ENGLISH GUNPOWDER.

By a report lately made to the Minister of War in France, it appears that the best powder made in that country is composed as follows: In 100 parts 78.00 saltpetre, 12.88 charcoal, 9.12 sulphur. The best Dartford powder contains 79.70 saltpetre, 12.48 charcoal, 7.82 sulphur. A *litre* of the former weighs 905 grammes, while a *litre* of the latter only weighs 857. The difference of density is occasioned by being subjected, in the manufacture, to different degrees of pressure; and it is stated by the French chemists, that the more dense the powder, so as not to check the combustion, the better. The strength of the French powder of this density is considerably greater than English powder; but reduced to the same density, they are nearly equal. But the French powder with which these experiments were made, was the patent powder of M Bouchet; and prior to his improvements, the best powder in France was 3-20ths less strong than that made in England. The comparison was made with Dartford powder; we believe, however, that a still stronger powder was, for a short time, made in England.

INQUIRIES.

NO. 78.—CALCULATING RUNNING WATER.

SIR,—I should like to be informed, through the medium of your Magazine, of a correct rule to calculate the quantity of water that will run through a rectangular aperture cut in the side (at the surface) of a vessel, kept constantly full, in a given time.

I have seen the following rule in an old treatise on Hydraulics:—

5,3472 . A . T . S *h*, calling A the area of the aperture in F, at S the time, and *h* the depth of the aperture in feet. This, says the writer, reduced in the ratio of *h* to 1, will give the true quantity discharged, nearly; but, from actual experiment, I find that this is not a correct rule; and if any of your learned Correspondents will give one that is, I shall be obliged to them.

I am, Sir,
Your obedient servant,

AQUA.

NO. 79.—MARINE STEAM ENGINES.

SIR,—Several readers of the Mechanics' Magazine, in this place, are anxious to be informed, by some of your practical Correspondents—

1st.—What ought to be the weight of a wrought iron boiler intended for a marine engine of twenty-horse power?

2ndly.—With what metal are the improved sliding valves and nozzles of marine engines now *faced*, and is there any nicety required in the mode of packing them?

3rdly.—Is a fly-wheel a necessary appendage to a marine engine?—if so, what proportion should its diameter bear to that of the paddle-wheel?

I am, Sir, yours, &c.

JUVENIS.

Chester, Nov. 17, 1824.

NEW PATENTS.

To Joseph Apsden, Leeds, Yorkshire, bricklayer; for his new invented improvement in the mode of producing an artificial stone. Sealed the 21st of October—two months for enrolment.

To George Dodd, St. Anne's, Westminster, engineer; for certain improvements on fire-extinguishing machinery. October 21—six months.

To George Samuel Harris, of Caroline-place, Trevor-square, Knightsbridge, Gent.; for his new invented machine, for the purpose of giving the most effectual and extensive publicity, by day and by night, to all proclamations, notices, legal advertisements, and other purposes, to which the same may be applicable, destined for universal information, and which will henceforward render unnecessary the defacement of walls and

houses in the metropolis and its vicinities, by bill-sticking, placarding, and chalking, which latter practices have become a great and offensive public nuisance. October 21—two months.

To John Lingford, Nottingham, lace-machine manufacturer; for his invention of certain improvements upon machines or machinery, now in use for the purpose of making that kind of lace commonly known or distinguished by the name of bobbin-net, or Buckinghamshire lace net. Nov. 1—six months.

To the Rev. John Somerville, A.M. Minister of the Parish of Currie, Edinburgh; for having invented a method, applicable to fowling-pieces or other fire-arms, by which method all accidental discharge of the said fire-arms will be completely prevented. Nov. 4—two months.

To John Crossley, Cottage-lane, City-road, London, Gent.; for a contrivance for better ensuring the egress of smoke and rarefied air in certain situations. Nov. 4—six months.

To Thomas Richard Guppy, Bristol, Gent.; for certain improvements in masting vessels. Nov. 4—six months.

To John Head, Banbury, hosier (Quaker); for certain improvements in machinery, for making cords or a plat for boot and stay laces, and other purposes. Nov. 4—four months.

To William Church, Birmingham, Esq.; for certain improvements in augers and bits for boring, and in the apparatus for making the same. Nov. 4—six months.

To William Busk, Broad-street, Esq.; for certain improvements in propelling ships, &c. Nov. 4—six months.

To John White, the younger, and Thomas Sowerby, Bishop Wearmouth, Durham, merchants; for their improved air furnace for the purpose of melting or fusing metallic substances. Nov. 6—four months.

To John Moore, Broad Weir, Bristol, Gent.; for his discovery of a certain addition to, or improvement upon, the steam engine, or steam engine apparatus. Nov. 6—six months.

To T. Cartmell, Doncaster, Yorkshire, gun-maker; for his invention of an improved cock, to be applied to the locks of guns, pistols, &c. for the purpose of firing the same by percussion, acting either by self-priming or otherwise, and whereby the priming is rendered wholly impervious alike to the wind, rain, or damp. Nov. 6—two months.

To Charles Heathern, Maidstone, lime-burner; for his new method of constructing furnaces or kilns, for the more speedy, effectual, and economical manufacture of lime, by means of applying, directing, and limiting the flame and heat arising in the manufacturing or burning coal into coke, and thus making lime and coke in the same building, and at the same time. Nov. 11—two months.

To William Leathy, Great Guildford-street, Southwark, engineer; for various improvements in machinery or apparatus used in the making of bricks, and certain improvements in the drying of bricks, by the means of flues and steam. Nov. 11—six months.

To Pierre Brunet, Wimpole-street, Cavendish-square, London, merchant: in consequence of a communication made to him by a certain foreigner residing abroad, with whom he is connected, he is in possession of an invention of a furnace made upon a new construction. Nov. 11—six months.

To Joseph Clisild Daniell, of Stoke, Wilts, clothier; for certain improvements in dressing woollen cloth. November 20—four months.

To Isaac Taylor, jun. of Chipping Ongar, Essex, Gent.; for his new-invented cock, or tap, for drawing off liquids. Nov. 20—four months.

To William Rhodes Baulins, Hoxton, Hackney, brick-maker; for his improvement in the construction of clamps for burning of rain bricks. Nov. 20—six months.

CORRESPONDENCE.

The Supplement to Vol. II. containing Preface, Titles, and Index, is now published. We regret that it has been so long in appearing.

Communications received from—A. F. Climax—M. S.—A Country Smith—Nadroj Samoht—A Correspondent—M. W.—B. S. (who will hear from us shortly)—R. W. B.—H. B. Wag—A School-Boy—Anne—J. W.—W. C.—J. B.—A Constant Reader and Old Man—Taffy—G. W.—F. Joyce—M. J. R.—G. A. S.—Inquisitor—F. F.—N. Noluet—A Becclesian—A Neglected Pupil—T. M. B.—J. S. x—Red Ink—G. W.—Hands and Feet—J. E. Coombs—A Journeyman Coachmaker—Y. Y.—Philo-Mechanicus—A Subscriber at Bradford—Wm. J. Osborne—And a paper without a signature, "On Beer and Thunder."

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.
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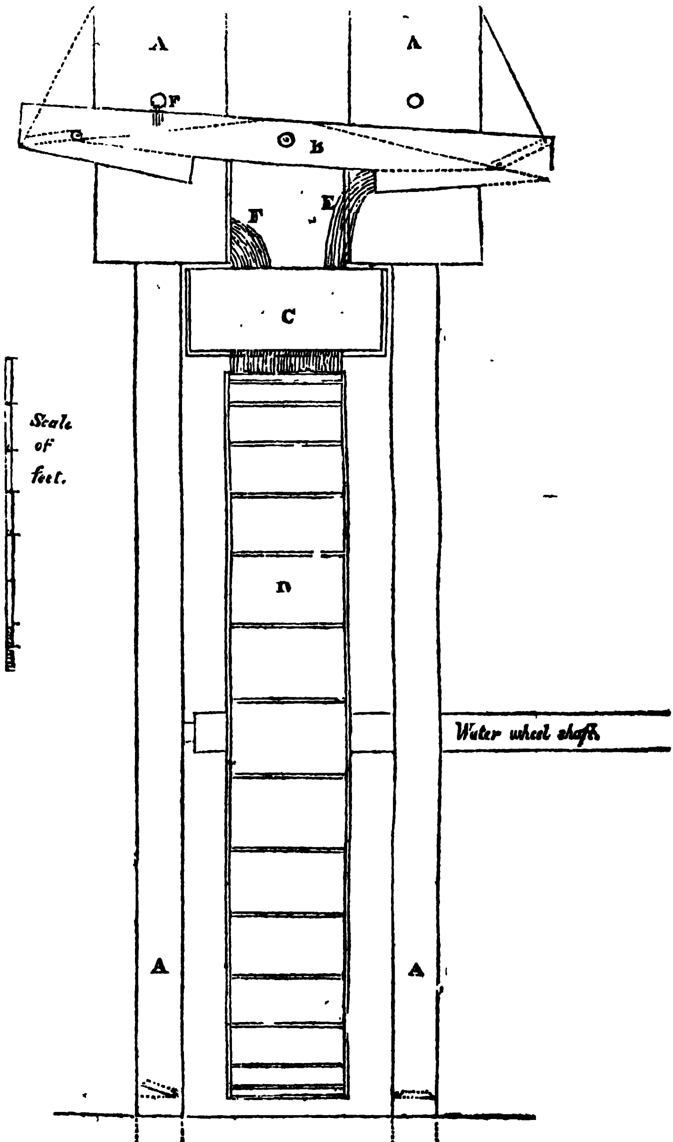
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 68.] SATURDAY, DECEMBER 11, 1824. [Price 3d.

IMPROVEMENT ON BROWN'S PNEUMATIC ENGINE.



IMPOVEMENT ON BROWN'S ENGINE.

SIR,—Having seen, with pleasure, in your Mechanics' Magazine, the plan of Mr. Brown's Pneumatic Engine, I take the liberty to say that it appears to me a power so simple need not be loaded with such a complication of machinery. I see no necessity, in particular, for the double cylinder, nor yet for the long rods and apparatus at the bottom; and in the preceding sketch I have endeavoured to show how the same effect may be produced by a single cylinder, with a trough beam (instead of the bottom apparatus) to receive a portion of the water, by the rising and falling of which the necessary cocks and valves will be opened and shut, and its water then discharged into the cistern below, to assist in working the water-wheel. Two such cylinders as this, working five strokes per minute each, would raise 2460 gallons of water 20 feet high, which is equal to a 30-horse power. If the vacuum were perfect, I presume it would raise it a trifle more, as 33 feet, I believe, is the highest point it could attain.

This description of pump would not only be of use to work machinery, but would be extremely useful to canals, to raise water from low to higher levels, at a small expense; also in brewhouses, where pumping and grinding are both wanted.

Description of the Plate in the preceding page.

AAAA represent two such cylinders, with valves at bottom.

B the trough-beam, to open cocks and vaives (with valves in bottom).

C the cistern to receive water and lay it on the wheel.

D the water-wheel (if wanted) to turn machinery.

E water discharging from the beam.

FF water discharging from opposite cylinder and into the beam.

The gas-pipes, cocks, &c. might be appended on Mr. Brown's principle to set it to work, and, if practicable, any extent of power that could be wanted, for whatever purpose, might be easily obtained.

I am, Sir,
Your obedient servant,
F. FLEET.

Banbury, Sept. 14, 1824.

PROVING THE SQUARE AND CUBE ROOTS.

SIR,—In the 64th Number, page 117, vol. iii. of the Mechanics' Magazine, there is a method laid down showing how the Square and Cube Roots may be proved by casting out the nines, by your Correspondent T. S. D. of Bath. A few years ago I discovered a method by which these roots may be proved in a manner somewhat different to that adopted by T. S. D. I communicated this discovery to my friend and patron, William Smith, Esq. of Peter's College, Cambridge, who was much pleased with it, as he considered it a method not known among arithmeticians at the time.

To prove the square root, proceed as follows:—

Take the excess of nines in the root found; square this excess, cast the nines out of this square, and note the remainder. Again—Find the excess of nines in the number proposed; from this excess subtract the excess of nines in the number remaining after the operation is finished, and if this remainder is not equal to the first noted remainder, the operation is certainly wrong; if the excess of nines in the number proposed happen to be less than the excess of nines in the number remaining after the operation is finished, we must add nine, and then proceed as before.

In the cube root we must cube the excess of nines in the root found, instead of squaring it, and the remainder of the process will be exactly the same as in the square root.

Let the proposed number be 3010573, the square root of which is 1735, and the remainder, after the operation is finished, is 348. The excess of nines in 1735 is 7; this squared is 49; the excess of nines in 49 is 4. Again, the excess of nines in 3010573 is 1, and the excess of nines in 348 is 6; therefore $9 + 1 = 10 - 6 = 4$ also. Now let the proposed number be 41784270, the cube root of which is 347, leaving a remainder, after the operation is finished, of 2347. The excess of nines in 347 is 5; this cubed is 125; the excess of nines in 125 is 8, the excess of nines in 41784270 is 6, and the excess of nines in 2347 is 7; therefore $9+6= 15-7=8$ also.

The above rules are founded upon this obvious principle:—In the square root, if the number remaining after the operation is finished be taken from the number proposed, the remainder is a perfect square if the work has been

correctly performed, and the method of proof is no more than that of common multiplication. For the same reason, if, in the cube root, the number remaining after the operation is finished be taken from the number proposed, the remainder is a perfect cube, when the work has been done right. From this it is evident that long division, in arithmetic, may be proved in the same manner; only we must take the excess of nines in the divisor and in the quotient, and proceed as before.

I am, Sir, yours, &c.

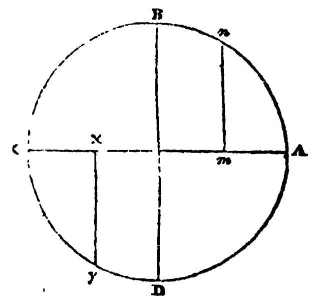
JOSEPH HALL.

Harpurhey (not Harpurley),
November 17, 1824.

MINUS.

SIR,—The question proposed by your Correspondent "Piger," (in page 52) why minus multiplied by minus produces plus, is certainly one of some difficulty; and as it has not been sufficiently explained in any book on Algebra with which I am acquainted, I was long of the same opinion with your Correspondent "Amicus," that the doctrine of negative quantities was untenable; the high authorities, however, on which this doctrine has been promulgated, has induced me to investigate the principle on which it is founded, and I at length have the satisfaction of being able to entertain a rational conviction of its truth. This conviction, however, has not been produced by any reasoning which I have seen on the subject, but is the result of my own analysation of the different cases to which I have found the principle applied; and this I shall endeavour to explain for the satisfaction of your Correspondents.

In the first place, it is necessary to have a clear conception of the meaning of the term *minus*, for on this hinges the chief difficulty of the case. Your Correspondents Piger and Roderick have both fallen into the common error of supposing that negative quantities are less than nothing, and, consequently, they cannot conceive how "less than nothing multiplied by less than nothing can produce something." This, indeed, would be an impossibility, but it is not the true state of the case; the term *minus* simply means *the reverse of plus*: it has no effect whatever on the magnitude of the quantity or number to which it is prefixed, but merely indicates that that quantity or number is to be estimated in the contrary direction to what it would be if the algebraic sign were plus: for example, seven feet depth is a measure of the same length as seven feet height, but estimated in the contrary direction; and, therefore, if the altitudes of several different objects were under consideration, and any of those objects were below the level of the observer, its depression might be expressed as an altitude, thus: height — seven feet. In like manner, a debt of seven pounds is a sum of money of the same value as a credit of seven pounds, but estimated in a contrary direction. All this is easily understood; the difficulty, then, is in conceiving of an abstract negative number; for instance, what idea can we affix to -866, when it stands unconnected with an affirmative number? To answer this question it will be necessary to refer to a diagram.



Let ABCD be a circle, of which the radius, AO, may be represented by the abstract number 1000; let the circumference be supposed divided into 360 degrees, commencing at A, and numbered quite round the circle in the direction ABCD, and from each of these divisions let a perpendicular be drawn to the diameter AC, as represented at mn and xy; then these perpendiculars will be what mathematicians term the sines of the arcs to which they correspond: thus, in the diagram, mn is the sine of the arc An, OB is the sine of the arc AB, and xy is the sine of the arc Ay. Now it is evident, from inspection of the figure, that these sines must fall above the diameter, AC, throughout the first half of the circle, or while the arc is less than 180 degrees, and below the diameter throughout the second half, or while the arc exceeds 180 degrees; if, therefore, in the former case they be considered affirmative, in the latter they must be consi-

dered negative. Suppose, now, the measured or computed length of all these sines were entered in a table, we should then obtain a clear idea how abstract numbers may be considered negative; a few of them may be exhibited thus :—

	Degrees.		
sine of	0	=	000
sine of	30	=	500
sine of	60	=	866
sine of	90	=	1000
sine of	120	=	866
sine of	150	=	500
sine of	180	=	000
sine of	210	=	− 500
sine of	240	=	− 866
sine of	270	=	−1000
sine of	300	=	− 866
sine of	330	=	− 500
sine of	360	=	− 000

Having thus gained the idea of negative numbers, we may naturally conclude (as experiment abundantly proves) that they will perform all the operations of arithmetic with the same infallible accuracy as affirmative numbers.

Let us now come to the question.—Why does a negative number multiplied by another negative number produce an affirmative number? To understand this, let it be remembered, in the first place, that multiplication is nothing more than abbreviated addition, and that the two factors, viz. the multiplicand and the multiplier are convertible terms, thus, 10 times 3 is the same as 3 times 10. Let it also be remembered that minus always means the reverse of plus; hence it must follow that, if either of the factors be minus, it will have the effect of reversing the algebraic sign of the other factor in the product, or, as may be otherwise expressed, an affirmative multiplier confirms the sign of the multiplicand, and a negative multiplier reverses it. This is the true rationale of the problem: it amounts to the same thing as saying that like signs in the factors produce plus, and unlike signs produce minus.

Should this reasoning not be thought sufficiently conclusive, the subject may be further illustrated by an example; thus, let $a=10$, $b=3$, $c=8$, and $d=2$; then the product of $a-b$ multiplied by $c-d$ may be found thus:

$$\begin{array}{l} a-b \\ c-d \\ \hline ac-bc-ad+bd. \end{array}$$

That this operation is correct, may be proved by substituting the above numbers (or any other number whatever) in place of the letters; it is, in fact, multiplying 7 by 6, which will produce 42.

Now let the factor, c, be struck out of the multiplier, and it is evident that all those terms in which it is found in the product must disappear; we shall then have $a-b\times-d=-ad+bd$. Again, let the factor a be struck out of the multiplicand, and all those terms in which it is found in the product must disappear; consequently both the factors, a and c, being struck out, all those terms in the product in which either of them appear must be cancelled, and we shall then have $-b\times-d=+bd$.

Substitute the corresponding numbers, and the proof will be equally convincing, thus:—

$$\begin{array}{c} 10-3 \\ 8-2 \\ \hline 80-24-20+6 \end{array} \quad \text{or} \quad \begin{array}{c} 7 \\ 6 \\ \hline 42 \end{array}$$

Take 8 from the multiplier, and it is evident that 8 times 7 (or 56) must be subtracted from the product; the operation will then stand thus:—

$$\begin{array}{r} 10-3 \\ -2 \\ \hline -20+6 \end{array} \quad \text{or} \quad \begin{array}{r} 7 \\ -2 \\ \hline -14. \end{array}$$

Again, in this last result, take 10 from the multiplicand, and it is evident that 10 times -2 (or -20) must be subtracted from the product, or, which is the same thing, $+20$ must be added to the product (an affirmative number added being equivalent to a negative number subtracted); we shall therefore have

$$-3\times-2=-14+20$$
or
$$-3\times-2=+6,$$

which was the case to be demonstrated.

It may be proper to remark that a multiplier can, in no possible case, be any thing but an abstract number; therefore the multiplicand and multiplier are convertible terms only when they happen both to be numbers. This is one cause of the difficulty of giving a familiar example of the multiplication of two negative terms; but it is hoped that the above example will prove to your Correspondents that the doctrine of negative quantities is founded on a rational basis, although

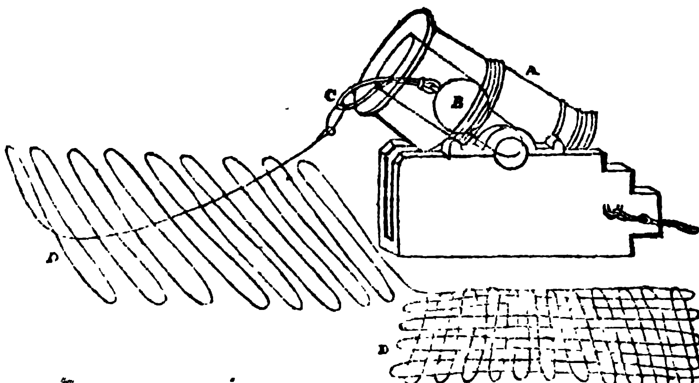
the train of reasoning it involves is perfectly abstract: this, however, can be no objection, when it is considered that affirmative numbers are equally abstract when considered in themselves, and without reference to the objects or magnitudes which they are applied to measure.

The solution of "Tyro Piger" (page 87) is perfectly correct, though I think too concise to prove convincing. The answer of "Legis" (page 125) is among the best I have seen, but he is mistaken in supposing that negative quantities can only produce a rational result when joined with affirmative ones. Were this the case, the powers of algebra would be very limited; it could, at best, be only considered as an auxiliary to geometry, whereas it is now applied so as nearly to supersede that science altogether.

I am, Sir,

Your obedient servant, M. S

BELL'S INVENTION FOR SAVING LIVES FROM SHIPWRECK.



Sir,—A great deal has been said, and I think to very little purpose, about the invention of the Mortar-plan for saving lives from Shipwreck. Your "Friend to Justice" makes it appear that Captain Manby claims the merit of this invention by his voluntary declaration: "I have never availed myself of any man's ingenuity; the whole has been the result of my own mind and perseverance." But Captain Manby, in his letter to you, denies having taken the credit for the invention, but claims to be considered the author; while your correspondent "W. B." states that Captain Manby received the first intimation of the plan from a Captain W——. Now, had any of your Correspondents given to the public, through the medium of your very useful Magazine, a description of this invention, it might not only have set the dispute at rest, but have been of service to the cause of humanity along the whole line of the coast of Great Britain. With this intent I send you the following description of the invention of Mr. Bell, which was tried and proved at Woolwich on the 29th of August, 1791, and for which, if Mr. Bell had received a few of the thousands since given for this invention, I will venture to say it would have been gratifying to every true friend to Justice; but *Non cuivis homini contigit adire Corinthum*, and *Infelicium pauci sunt affines*.

Tibi sum devinctissimus,

Vindex.

Description.

a Represents an eight-inch mortar on its carriage (of which Mr. Bell observes, that accidents from a gun bursting are effectually guarded against, by the chamber being constructed to contain but one pound of powder); *b*, the shell shown within the mortar by dotted lines; this was of cast iron filled with lead, by which means Mr. Bell gained 7 lbs. in weight, making his shell weigh 75 lbs. instead of 68 lbs.; *c*, the grommet, or double rope,

which connects the shell and line—this was of white three-inch rope; *dd*, the line, French-faked, or laid in a zig-zag direction before and by the side of the mortar, as recommended by a French inventor of a similar plan, about the year 1790 or 1791.* Mr. Bell coiled his line on handspikes. The line first tried by Mr. Bell was a deep-sea line, of which 160 yards weighed 18 lbs.; this line, with the shell, was thrown 400 yards from the mortar, elevated 45 degrees, and with a charge of only 15 ounces of powder.

Mr. Bell recommended his plans to be adopted as they are at present, in the following remarks:—"There is every reason to conclude that this contrivance would be very useful *at all ports of difficult access*, both at home and abroad, where ships are liable to strike the ground before they enter the harbour, as Shields Bar and other similar situations; *when a line might be thrown over the ship*, which might probably be the means of saving both lives and property; and, moreover, if a ship was driven on shore near such a place, the apparatus might easily be removed to afford assistance; and the whole performance is so exceedingly simple, that any person, once seeing it done, would not want any farther instructions.

"JOHN BELL.

"Woolwich, Aug. 29, 1791."

Models and drawings of the apparatus are preserved in the repository of the Society of Arts for public inspection. An account of the invention was also published in the Trans. Soc. Arts, vols. x. and xxv., and in Nicholson's Phil. Journal, vol. xx. The description of a similar plan, tried by a French author, will be found in the Naval Chronicle for 1799.

* See Naval Chronicle, vol. II. p. 428.

ERRORS IN NATURAL HISTORY.

The stories, that there is but one phœnix in the world, which, after many hundred years, burns herself, and from her ashes rises another; that the pelican pierces her breast with her beak to draw blood for her young; that the cameleon lives only upon air; of the bird of paradise, and of the unicorn, are all fabulous.

It is an error, that the scorpion stings itself when surrounded by fire, and that music has power over persons bitten by it; that the mole has no eyes, and the elephant no knees; that the hedge-hog is a mischievous animal, particularly that he sucks cows when they are asleep, and causes their teats to be sore.

It is said that the porcupine shoots out its quills for annoying its enemy, whereas it only sheds them annually, as other feathered animals do. The jackall is commonly called the lion's provider, but it has no connexion with the lion. The bite of the spider is not venomous; it is found too in Ireland plentifully—has no dislike to fixing its web on Irish oak, and has no particular aversion to a toad.

The ass was vulgarly thought to have had a cross on its back ever since Christ rode on one of those animals. It was also believed the haddock had the mark of St. Peter's thumb ever since St. Peter took the tribute penny out of a fish of that species.

It was anciently believed, says Brand, that the barnacle, a common shell-fish, which is found sticking on the bottom of ships, would, when broken off, become a species of goose. Nor is it less an error, that bears form their cubs by licking them into shape; or that storks will only live in republics and free states.

"The Rose of Jericho," which was feigned to flourish every year about Christmas Eve, is famous in the annals of credulity; but, like the the no less celebrated "Glastonbury Thorn," is only a monkish imposture.

It is commonly believed, and even proverbial, that puppies see in nine days; but the fact is, they do not see till the twelfth or fourteenth.

WOOLCOMBER'S STEAM-CHEST.

SIR,—The Woolcomber's Steam-Chest, described by Mr. Saul, of Lancaster, is quite useless, the heat being barely sufficient for *smoothing* the very finest wools. The best and

most economical method of heating comb-pots is by carrying a spiral flue over the top-plate. Several pots, so constructed, are now on sale at the Broomsgrove Worsted-mill.

I am, Sir,
Your obedient servant,
W.

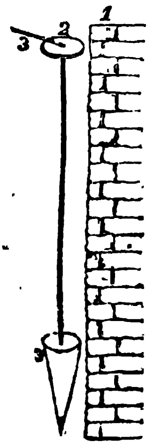
USE OF THE PLUMMET.

SIR,—The Plummet is an instrument of such general application, that any improvement in the mode of using it will be viewed with some interest by the attentive mechanic. The ancient ball of lead, of a spherical form, has been for a long time laid aside by the superior artisan for the *conical* plummet, by which a person is enabled to determine the correct spot under the point of suspension, which could not be done so accurately, and with so little trouble, by the spherical bob.

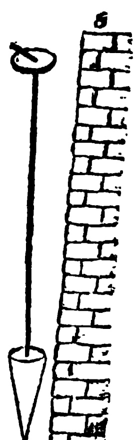
I have, for many years, made an addition to the conical plummet, which is very simple, but not the less useful; it consists of a *circular plate* of brass, or other metal, with a small hole in its centre, to admit the plumb-line. This circular plate being made *exactly of the same diameter* as the largest part of the conical weight or bob, serves at once to prove the truth or accuracy of any vertical wall or plane, without the addition of the plumb-rule, and is applicable at once to walls of any height; for, when the upper part of the line is placed in the centre of the above-mentioned circular plate, and the edge of the plate held in contact with any upright wall or post, the surface of the conical weight will also be in contact with the lower part of the said plane, provided it is truly vertical; and if it should have any inclination, or be out of upright, the plummet will discover the quantity by its distance from the wall, in case it overhangs, and, in case it recedes or batters, the distance of the circular plate from the upper part of the wall or post will measure the quantity of declination or battering.

As the line attached to the plummet may occasionally have knots upon it, I have found it convenient to make a narrow slit sufficient to admit the line from one side of the said plate to the centre. The mode of application, perhaps, may be better understood by the following figures:—

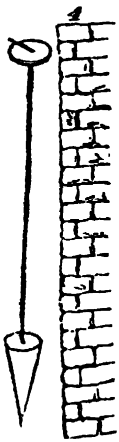
When the plane is upright.



When the plane inclines backward.



When the plane inclines forward.



I remain, Sir,
Yours truly,
B. BEVAN.

PORTABLE PUMPS FOR EXTINGUISHING FIRE.

SIR,—In Nicholson's Philosophical Journal for June, 1803, I met with a letter from M. Van Marum to M. Berthollet, containing an account of some experiments showing the method of extinguishing violent fires with very small quantities of water, *by means of Portable Pumps*; and as this method appears to me, from its simplicity, capable of being made extremely useful, not only in crowded cities but on board ships, I request you will have the goodness to give it a more general circulation by inserting the following brief account of it in the Mechanics' Magazine.

The experiments of Van Aken, a Swede, which were published in 1794, and which gave rise to Van Marum's, were performed with a liquid of the following composition, viz. 40 lbs. of sulphate of iron, and 30 lbs. of sulphate of alumine, mixed with 20 lbs. of the red oxide of iron and 200 lbs. of clay. By a series of experiments Van Marum proved that fire was always extinguished more quickly with common water, used in the same manner, than by this anti-incendiary liquor; and "I observed (he says) at the same time, that a very inconsiderable quantity of water, if judiciously directed, would extinguish a very violent fire." The result of his first experiment was the extinguishing the fires of two casks covered with pitch, their heads taken out, and highly ignited, *with only four ounces of water*. I shall give you his instructions at length, as follows:—

"According to these experiments, it appears that the act of extinguishing a violent fire with a small quantity of water consists in this—that the water be thrown on that part of the fire which is the most violent, so that the quantity of steam produced, which suppresses the flame, may be the greatest possible; that water be continued to be thrown on the neighbouring inflamed part as soon as the fire has ceased in that on which the operation was begun, and that all the burning parts be visited in this way as quickly as possible. By thus following the flames regularly with streams of water, they may be every where suppressed before the part on which the operation was begun shall have entirely lost, by evaporation, the water with which it was moistened: this is often necessary to prevent the parts from breaking out afresh, for, on the principle above mentioned, a burning body, of which the flames are suppressed, cannot be again in flames until the water thrown on it be totally evaporated."

In May, 1797, Van Marum prepared a shell of dry wood, forming a room 24 feet long, 23 feet wide, and 14 feet high, having two doors on one side and two windows on the other; the inside was strongly pitched and covered with twisted straw, wood shavings, and cotton soaked in turpentine. "Very soon after lighting it (he says), the flames being rendered more brisk by the wind, were every where so violent that it was considered by my assistants as impossible to extinguish them. I succeeded, however, after the method above directed, in little more than four minutes, and with five buckets of water, a part of which was wasted by the negligence of my assistants"

This experiment was repeated in

the same month, and the fire extinguished in three minutes, with less than five gallons of water.

A similar experiment was repeated, with equal success, by Dr. Van Marum, in the presence of the Duke and Duchess of Gotha, at Gotha, in July, 1798; an account of which was published by the celebrated astronomer Von Zach, in a German periodical paper entitled *Reich's Anzeger*, 6th of August, 1798, No. 119, where he assures us, that *the fire was extinguished, with three buckets of water, in three minutes, with a small portable pump.*

Van Marum concludes with the following observations:—" In operations of this kind particular attention must be paid to throwing the water in such a way that the entire surface of the burning part shall be wetted and extinguished, and that in such a way that an extinguished part shall never be left between two others which are in flames; for, if attention be not paid to this, the heat of the flames burning here and there will quickly change the water, with which the part has been wetted, into steam, and the whole will again take fire. In order, then, to extinguish a fire in all cases, no more water must be thrown on the burning part than is needful to wet the surface, and this I conceive to be all that is requisite to extinguish a fire, whatever may be the circumstances of its origin."

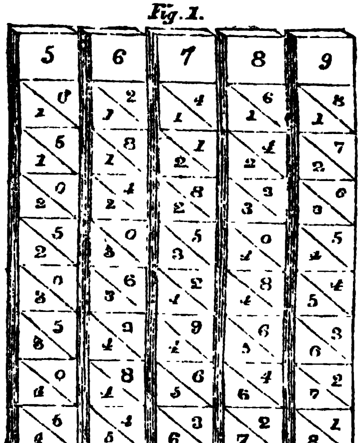
In 1807, Mr. Hornblower, with whose talents the world is well acquainted, constructed a fire-engine which stood in the compass of fourteen inches square and two feet high, and could be carried from one room to another with ease. He found, by experiment, that the four sides of a bed-room, all on fire, could be extinguished in a minute by little more than a pail of water. All that is required is, to keep the engine filled in its proper place, and to work it off every month or six weeks, for the purpose of changing the water, and ascertaining that it is in proper working state.

I am, Sir, &c.

NAVARCHUS

NAPIER'S BONES.

Fig. 1.



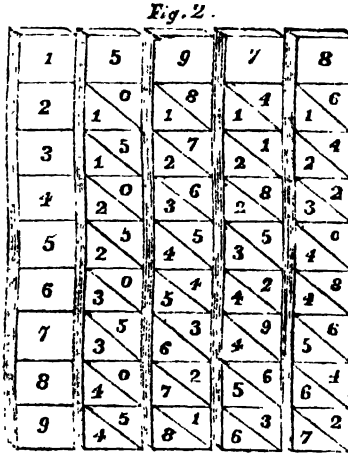
The rods known by the name of Napier's Rods, or Bones, were contrived by Lord Napier for the more easy performing of the arithmetical operations of multiplication, division, &c. &c. These rods are five in number, made of bone, ivory, horn, wood, or pasteboard, &c. Their faces are divided into nine little squares, each of which (see figs. 1 & 3) is parted into two triangles by diagonals. In these little squares are writ-

ten the numbers of the multiplication table, in such manner as that the units, or right-handed figures, are found in the right-hand triangle, and the tens, or the left-hand figures, in the left-hand triangle.

To multiply numbers by Napier's bones, dispose the rods in such a manner as that the top figures may exhibit the multiplicand, and to those on the left-hand join the rod of units, in which seek the right-hand figure of the multiplier, and the numbers corresponding to it, in the squares of the other rods; write out, by adding the several numbers occurring in the same rhomb together and their sums. After the same manner write out the numbers corresponding to the other figures of the multiplier, disposing them under one another as in common multiplication; and, lastly, add the several numbers into one sum. For example, suppose the multiplicand 5978, and the multiplier 937.

```
   5978
    937
-------
  41846
 17934
53802
-------
5601386
```

Fig. 2.



From the outermost triangle (fig. 2) which corresponds to the right-hand figure of the multiplier 7, write out the figure 6, placing it under the line. In the next rhomb towards the left, add 9 and 5; their sum being 14, write the right-hand figure 4 against 6, carrying the left-hand figure 1 to 4 and 3, which are found in the next rhomb; join the sum 8 to 46, already set down. After the same manner, in the next rhomb, add 6 and 5, and the latter figure of the sum, 11; set down as before, and carry 1 to the 3 found in the left-hand triangle; the sum 4 join, as before, on the left-hand of 1846: thus you will have 41846 for the product of 5978 by 7. And in the same manner are to be found the products for the other figures of the multiplier, after which the whole is to be added together as usual.

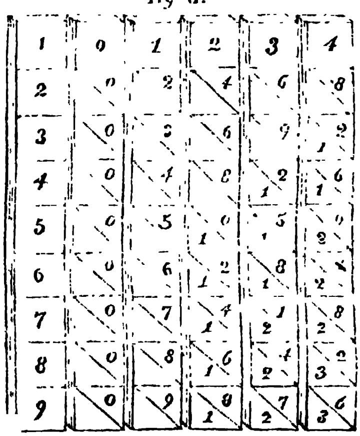
To perform division, dispose the rods so that the uppermost figures may exhibit the divisor; to those on the left-hand join the rod of units; descend, under the divisor, till you meet those figures of the dividend in which it is first required how oft the divisor is found, or at least the next number which is to be subtracted from the dividend; then the number corresponding to this, in the place of units, set down for a quotient; and, by determining the other parts of the quotient in the ame manner, the division will be

completed. For example: suppose the dividend 5601386, and the divisor 5978.

```
5978)5601386(937
     53802
     -----
      22118
      17934
      -----
       41846
       41846
       -----
```

Since it is first required how oft 5978 is found in 56013, descend under the (fig. 2) divisor till, in the lowest series, you find the number 53802 approaching nearest to 56013, the former of which is to be subtracted from the latter, and the figure 9 corresponding to it in the rod of units set down for the quotient. To the remainder, 2211, join the following figure, 8, of the dividend; and the number 17934 being

Fig. 3.



found, as before, for the next less number to it, the corresponding number 3 in the rod of units is to be set down for the next figure of the quotient. After the same manner the third and last figure of the quotient will be found to be 7, and the whole quotient 937.

LONDON MECHANICS' INSTITUTION.

FOURTH QUARTERLY MEETING.

The Fourth Quarterly General Meeting of this Institution was held on Wednesday evening, the 1st of December.

Mr. Blake, Honorary Secretary, read the Report of the Committee of Managers.

It commences by offering the sincere congratulations of the Committee "*on the continuance of that cordial co-operation on the part of the Mechanics of the Metropolis,* which they confidently anticipate will enable them, at no very distant period, to carry into complete effect all the important purposes contemplated by the establishment of the Institution."

It then proceeds to give a summary of the Committee's proceedings during last quarter. At the commencement of it they took possession of the premises in Southampton-Buildings, and immediately effected an insurance in the Imperial Fire Office for 1000*l.* on the furniture, apparatus, and books belonging to the Institution; the premises being already insured in the same office for 2500*l.* up to Christmas next, agreeably to a covenant in the lease. The Committee, in a few days after, opened a commodious Reading-Room, and appointed a Sub-Committee to superintend the necessary

arrangements for conducting it. They have also directed the appropriation of 50*l.* from the funds of the Society, to the purchase of additional books and maps for the library, only a part of which has yet been disbursed. The purchases already made, together with numerous donations of valuable works, have added 306 volumes to the library during the quarter.

The erection of a Theatre or Lecture-Room on the plot of ground adjoining the premises in Southampton-Buildings, being an object of serious importance, the Committee procured several excellent plans, by the kind and gratuitous assistance of a number of gentlemen, and appointed a Sub-Committee of Works to take the various plans into consideration, from which an excellent one has been selected.

With respect to the means of defraying the unavoidable expense which must be incurred for the erection of the Lecture-Room, the Committee state that "every difficulty, which might have been apprehended from the want of adequate funds for this important purpose, has been removed by the handsome and liberal offer of the worthy President to advance whatever sums may be required, in addition to subscriptions and other resources, at an interest of 4 per cent."

The Committee state, that the next subject of importance to which they directed their attention, was the establishment of Elementary Schools, for the instruction of the members in arithmetic, algebra, geometry, trogonometry, &c. and that a Sub-Committee having been appointed for this purpose, the various applications received from members desirous of enrolling their names as pupils were taken into consideration, when it appeared, that the applicants for arithmetical instruction were by far the most numerous; and it was accordingly determined that the Elementary School of Arithmetic should be the first opened.

The Committee having maturely examined the qualifications of more than thirty Gentlemen who offered themselves as candidates for the situation of arithmetical teacher, have engaged Mr. Collins, of Hatton-garden, in that capacity.

The various duties incumbent upon the Secretary requiring his frequent absence from the premises in Southampton-Buildings, and it being indispensably necessary that some person should be constantly in attendance, the Committee have engaged an assistant to the Secretary, for the protection of the property of the Institution, and the accommodation of the members frequenting the Reading-Room, or attending at the office on business, and have taken proper security for the due performance of the duties attached to his situation.

The number of members who have actually paid up their subscriptions to the present period, was stated to be about 750.

A Sub-Committee has also been appointed for the purpose of arranging the collection of philosophical apparatus, models, minerals, &c. belonging to the Society, a considerable portion of which has been already deposited in suitable glass cases; and the Apparatus Committee expect that in a short time their arrangements will be completed for submitting the Museum to the general inspection of the members.

On the conclusion of the reading of the Report,

A Member observed, that he could not subscribe to it until he received some explanation as to the probable expense of the new building.

Mr. Macwilliam, one of the Vice-Presidents, stated, that it was estimated to amount to about 2500*l.*

The Report was then approved of, *nem. con.*; and after votes of thanks to the Committee and Sub-Committees, the President, &c. the Meeting separated.

THE NEW LECTURE-ROOM.

The 2d of December last being the first Anniversary of the formation of the London Mechanics' Institution, the first stone was laid of an edifice to be used as a Theatre, for delivering the Lectures of the Professors on the premises occupied by the Institution in Southampton-Buildings. A bottle was deposited in a cavity of the stone, containing a book of the laws of the Institution—the 10th Number of the *Mechanics' Magazine*, which contained an account of the first meeting of the members—a vellum roll, on which were inscribed the names of all the officers of the Institution, and a portrait of Dr. Birkbeck, the President.

After the stone was laid, the President addressed the Meeting in nearly the following words:—

"Now have we founded an edifice for the diffusion and advancement of human knowledge. Now have we begun to erect a Temple, wherein man shall extend his acquaintance with the universe of mind, and shall acquire the means of enlarging his dominion over the universe of matter. In this spot hereafter the charms of Literature shall be displayed, and the powers of Science shall be unfolded, to the most humble inquirers; for, to 'the Feast of Reason' which will be here prepared, the invitation shall be as unbounded as the region of intellect.

"For an undertaking so vast in its design, and so magnificent in its object, (nothing short, indeed, of the moral and

intellectual amelioration and aggrandizement of the human race), the blessing of Heaven, I humbly trust, will not be implored in vain. If in this Institution we seek to obey the mandate which has gone forth, that knowledge *shall be increased;* if we act in obedience to the injunction, that in all our gettings we should get understanding; if we succeed in proving, that for the existence of the mental wilderness, the continuance of which we all deeply deplore, we ought 'to blame the culture, not the soil;' if by rendering man more percipient of the order, harmony, and benevolence, which pervade the universe, we more effectually 'assert eternal Providence, and justify the ways of God to man;' and if thus we shall be the happy means of rendering it palpable, that the immortal essence within us, when freed from the deformity of ignorance and vice, has been created in the express image of God—then may we confidently hope that Omniscience will favourably behold our rising structure, and that in its future progress, Omnipotence, without whose assistance all human endeavours are vain, will confer upon us a portion of his powers.

"Whilst I remind you that the illustrious Bacon, long ago, maintained that 'knowledge is power,' I may apprise you that it has, since his time, been established, that knowledge is wealth—is comfort—is security—is enjoyment—is happiness. It has been found so completely to mingle with human affairs, that it renders social life more endearing; has given to morality more uprightness; and, politically, has produced more consistent obedience; it takes from adversity some of its bitterness, and enlarges the sphere, as well as augments the sweetness, of every laudable gratification; and, lastly, unquestionably one of its brightest influences—it becomes at once an avenue and a guide to that 'temple which is not made with hands, eternal in the heavens.'"

ANNIVERSARY DINNER.

The Patrons and Members afterwards dined together at the Crown and Anchor Tavern; Dr. Birkbeck in the Chair. As soon as the cloth was removed,

Dr. BIRKBECK gave "The health of the King," which was drank most enthusiastically.

Next followed—

"His Royal Highness the Duke of York."

"His Royal Highness the Duke of Sussex."

Dr. BIRKBECK then gave, "Prosperity to the London Mechanics' Institution."—(Great cheers.)

Mr. BROUGHAM rose to propose "The health of their able, excellent, and valuable President, Dr. Birkbeck."—(Cheers.)—For thirty years he had the pleasure of knowing Dr. Birkbeck, and his life, his merits, his worth, his talents, and the singleness of his devotion to their interests and those of mankind at large, proved how worthy he was of the tribute they were now to render to him. It was not here the system of these institutions was commenced, for it had long been in progress. It was twenty-four years ago since Dr. Birkbeck laid the foundation of such a Society at Glasgow, which, in its extent and real use, was second only to that now established. A better system would now gradually operate; and though in Scotland the system was known, it was not followed up till on the present occasion. A School of Arts, it was true, had arisen at Edinburgh, but the roots had not stricken deeply nor widely; but since the last twelve months, almost every great town in the country had followed the example of London. Vices were incident to all great towns, but it was a compensation to mankind for such evils, that Societies like the present were instituted. When the metropolis, the heart of the country, was thus imbued, the far-off branches were nourished and supported. It was no wonder that in the larger towns this system prevailed; for there the elements were ready, at a touch, to be called together. But it was a great pleasure to find the smaller towns—towns with three or four thousand inhabitants, anxious to have similar Institutions. At Kendal there was one; at Hawick, in the south of Scotland, another. A difficulty was found in providing able lecturers; but such was the zeal of a few good men, that the people of the towns had lectures delivered to them, a library, and every thing to ensure the accomplishment of such desirable objects. The smaller the towns the greater their praise; and when all, encouraged by the success in London, were emulating her Institution, he felt they need not live long to see every mechanic blessed with an Institution like this. Without the zeal and operation of the mechanics little could be done, and he called upon all to come forward and contribute apparatus and books to the Society. He cared not for the talk of men's doing good—of being charitable and friendly to the cause of freedom, if he saw them allow in their own neighbourhood any large number of mechanics to be without a local Mechanics' Institution. These Institutions could be safely adopted by persons of all sects and parties; and conscientiously as they might differ on those points, they could agree on principles of science. He would explain himself. The great question agitated in this country was—had the people a sufficient share in the government of this country? Some said they had; some that they had not: honest men on both sides said so, and God forbid he should blame those with whom he differed. But

Institutions like this informed the people, and the better they were informed, the more capable were they of participating in the affairs of Government. The people would be more fit to manage for themselves, the more they knew; and there were few Governments who did not feel so. About fifty years ago, a Frenchman (looking at the progress of knowledge) said, the people would see fine things; so they did. So in this country—so in North and South America; and before the next fifty years arrived, he ventured to say that mankind in general would be found to be more generous, more virtuous, and more wise. Nay, even in five years to come, the knowledge, and therefore the power of the people, would be found greater, whether that knowledge worked openly or in secret. For such they were indebted to the worthy person in the Chair, and he could not discharge his duty better than by giving "The Health of Dr. Birkbeck."—(Applause.)

The CHAIRMAN.—The manner in which you have drunk my health demands my best thanks. The effects achieved by my humble efforts are my best reward. It is enough for me to see what has been done, and is doing. My efforts to assist the uneducated were feeble, and the classes I endeavoured to assist were neglected, because the light of science did not shine upon them. We had not means to go on. But within the last twelve months, it would appear that intellect has gained ground; for no sooner was an appeal made to the mechanics of London and Glasgow than it was immediately answered. Its present gigantic appearance would in other times be considered as only the work of magic. It was unnecessary to travel through the history of this Institution or that of Glasgow, as he had been ably anticipated on that subject: however, he would briefly allude to what had occurred that day. They were that day met to commemorate the first anniversary of an Institution which formed an era in the history of the country. In the Temple, of which the first stone was this day laid, the mind would find recreation, and the moral habits of man improvement. The intellectual being would feel his nature elevated, and man would learn to find himself framed after the image and likeness of the Divinity. In that Temple the stores of knowledge would be unfolded—the progress of reason accelerated—science shed her lights, and our physical condition be improved. In that Temple all would be admitted; nay, the invitations to enter it should be as wide as the dominion of mind itself. It had long ago been said by Bacon, that knowledge was power; and every day's experience since fully confirmed that assertion. Knowledge was not merely power—it was wealth, comfort, enjoyment, happiness—it was the solace of anguish, the soother of disappoinsment; it heightened rational pleasure, and gave a keener relish to enjoyment. The mental faculties would then be more amply developed; and it would afford at once the avenue to, and be the guide of, every useful species of knowledge. Age would then be comforted, youth instructed, manhood confirmed in the principles of science and morality, and the general condition of our nature elevated and sublimed; the grosser passions would be restrained, and man would walk abroad in his elevated majesty. Every thing on earth was submitted to his control, and created for his use; and it was to be hoped, that while he was there taught to see and feel the beauty and the harmony of all the works of art, man would soar above his terrene views, and prove, by his better conduct, and his more refined morality, that he was not ungrateful to the great bountiful Author of his creation.

Mr. HUME introduced, with some appropriate remarks, "The health of the Trustees."

Mr. BROUGHAM returned thanks.

The Secretary then read letters from Mr. John Smith, M.P., Mr. Hobhouse, M.P., and Mr. J. Walker, M.P., apologising for their absence.

"The healths of Sir Francis Burdett, Mr. Hobhouse, Mr. John Smith, Mr. Abercrombie, Mr. Walker, and other absent friends," were next drunk.

Mr. Alderman WOOD proposed "The health of the Vice-Presidents."

Messrs. MARTINEAU, GILCHRIST, and MACWILLIAM, respectively returned thanks.

Next followed "The health of the Honorary Solicitor."

Mr. TOOKE returned thanks.

The CHAIRMAN, in proposing the healths of Messrs. Robertson and Hodgskin, bore testimony to the great services which they had conferred upon this Institution at the period of its commencement. Their labours were able, though unfortunately, from some cause or other, latterly estranged; but, despite the differences which had occurred, the Institution were deeply indebted to them. "Gentlemen, I shall now propose the healths of our friends—The enlightened Editors of the *Mechanics' Magazine*." * Their labours gave an impetus to your efforts; you followed them; and in doing so you have acted well and wisely.—(Applause.)

* As the wording of this toast may cause some misapprehension, and tend to throw on an esteemed friend a share of responsibility inconsistent with the part he has taken, it is but right to state, that Mr. Hodgskin has, for a considerable time, ceased to have any connexion with the Mechanics' Magazine.—ED.

Mr. HODGSKIN said that his feelings were those of mingled humility and pride—humility, because he was conscious of the few efforts he had made in behalf of the Institution, and pride that those few efforts were thought worthy of so much honour. He felt humble also, because his colleague and friend, who could have expressed the thanks of both so much better than he could, was absent, and he, without possessing abilities adequate to the task, would have to trespass for a few moments on the attention of the Meeting. In what he was about to say, he was actuated by a desire to do justice to his absent friend and himself, and to point out an error which had recently been committed in a very celebrated work. In the forthcoming number of the *Edinburgh Review*, Mr. Hodgskin said, there was an article on scientific education; and in this article, which, as far as he could judge from a cursory view, was well calculated to advance the interests of the mechanics, and promote their scientific instruction, there was the following passage:—"When Doctor Birkbeck reflected on the success of his plan, both at Glasgow, and now, since it was established in a place (Edinburgh) far less abounding in artisans, it is not to be wondered at that he should have conceived the idea of giving its principles a wider diffusion, by the only means which seem in this country calculated for the general circulation of any scheme—its being patronised in London. He and a few of his friends accordingly called the attention of the metropolis to it about the end of last year, and the proposition met with all the encouragement that might have been expected both from the master mechanics, the workmen, and the friends of knowledge and improvement." In this passage Mr. Hodgskin said there was a mistake, which, in justice to his absent friend and himself, he was called on to rectify. The President of the Mechanics' Institution had already too many claims to the gratitude of mankind, that he should be at all desirous of appropriating to himself the little honour that belonged to much humbler individuals. In fact, he had already told the Meeting that the proposition for forming a Mechanics' Institution originated in the *Mechanics' Magazine*. The fact was, that the idea of such an Institution first occurred to Mr. Robertson, with whom Mr. Hodgskin was then associated in conducting that work; that he mentioned the idea to Mr. Hodgskin, that they talked it over, and that he (Mr. Hodgskin) drew up the paper, which, with some alterations by Mr. Robertson, was published, proposing the formation of a Mechanics' Institution. They had certainly caught the idea from the Institution at Glasgow, and from the School of Arts at Edinburgh; but at the time the paper was published, neither of them knew that Dr. Birkbeck was alive, and knew not that he was in London. Certainly Dr. Birkbeck wrote immediately to the Editors, offering his co-operation, and it was his (Mr. Hodgskin's) belief, that without Dr. Birkbeck's name and active assistance, the Society never would have been carried into effect.* In the humble efforts which he, Mr. H. had made to advance the education of the mechanics, he had been stimulated by observing, that the progress they had already made had done much to elevate them in society. In the ancient world all mechanical operations were carried on by slaves; and even Cicero had said, "that there can be nothing ingenious in a workshop; that commerce, when conducted on a small scale, is mean and despicable, and, when most extended, barely tolerable." Of this ancient prejudice modern mechanics were still the victims; and if they were at all raised above it, they owed it partly to their working with quite different tools, and employing very different instruments, than their predecessors. They were no longer mere workers with edged tools, but had pressed the great powers of nature into their service. The mechanic in the gas works was a chemist of considerable skill, and converted a quantity of coals, by his chemical skill, into products of ten times their value. In the manufacture and use of steam-engines he used that same expansive power which rent asunder the highest mountains. It was seeing what they had already performed which led him to hope so much from, and do what he could to promote, the scientific instruction of the people; for it was impossible to tell what, at present, unknown powers they might yet press into the service of mankind, when instruction was within their reach. It was also worthy of remark, that as they

* Mr. H. did himself and his former colleague some injustice in saying so. No disposition has ever existed on the part of the undersigned to depreciate the value of Dr. B.'s name and assistance; but when he finds it stated that, *without these*, the design which he promulgated would never have been carried into effect, he may be excused for stating the simple matter of fact, that the whole of the proceedings of the first General Meetings, by which the design *was carried into effect*, were organized by his colleague and himself. He need but appeal to Dr. Birkbeck's own testimony on the subject. In his inaugural address to the public, these were his words:—"My friends, Mr. Robertson and Mr. Hodgskin, your original temporary secretaries, first gave currency to the plan, *and were the powerful means of organizing our first public movements*."—See vol. I. p. 420.

J. C. R.

had found out or employed new powers, they had created new professions and new trades, which, simply because they did not exist when our ancient restrictive laws were enacted, were exempted from their operation. This was an encouragement to the mechanics to proceed in their good work, for they might in this see a means of emancipating themselves and their posterity from all these barbarous restrictions; and they might also see in it a strong evidence of that general kindness and benevolence of nature which found out, in the progress of man, a remedy even for the follies of legislators. Mr. Hodgskin concluded by returning his sincere thanks to the Society for the honour it had done him, and said he should remember that day as the proudest of his life.

Next followed "The health of the Lecturers."

Mr. COOPER returned thanks.

Lieutenant-Colonel TORRENS proposed "The City of London."

The next toast from the Chair was, "The health of Joseph Hume, Esq. M.P."

Mr. HUME rose to return thanks, and was most warmly applauded. He said that the interests of the mechanics had long occupied his attention. He had been for a considerable time of opinion, that the system of Combination Laws which had existed were contrary to the true spirit of English law, which dealt out equal justice to the rich and the poor, and, acting upon that principle, he had exerted himself for their repeal. His exertions had fortunately been successful; and in consequence of these alterations the artisans were now in a fair way of enjoying all the advantages which their skill and industry entitled them to receive.

Shortly afterwards the Chairman retired, and the Meeting separated.

We cannot dismiss these different proceedings without adding a very few remarks.

Much of the fine speaking of Dr. Birkbeck and Mr. Brougham proceeds on an assumption which, in point of fact, is *not true;* namely, that the "*mechanics of the metropolis*" have given their "cordial co-operation" to the Institution, and that "*it has stricken its roots deeply among them.*" The total number of members is stated, in the last Quarterly Report, to be only about 750, and we have stated our belief (*vide* Supplement to vol. II.), that of this number not more than one-half are working mechanics; this, too, after the Institution has been a whole year established. But what is three or four, or even seven hundred, compared with the number of mechanics in the metropolis? It is ridiculous to call this a representation of the working classes of London. One or two only of our large manufactories might have turned out the whole number. In Edinburgh, where there are but few manufactures, and which has not a tenth of the population of the metropolis, there is a School of Arts, which (notwithstanding Mr. Brougham's depreciating statement) boasts of quite as many mechanics on its roll as this, which is deceptively called the London Mechanics' Institution.

In stating our objections to the proposed building (see Supplement to vol. II.), we hinted that the load of debt which the erection of it would bring on the Institution might tend to place it in a state of dangerous subserviency to the individuals who might choose to constitute themselves its creditors. Our anticipations are rapidly realizing. *Dr. Birkbeck*, it appears, is to advance whatever money may be wanted, at four per cent. interest. No person who knows any thing of the ways of the world can be at a loss to perceive to what consequences this must lead. If Doctor Birkbeck had no design of imposing himself in an attitude of undue influence on the Society, why is not the loan made an open one—why does Dr. B. monopolize the oppportunity of obliging the Society—more especially when money on good security can be procured for so much less a rate of interest than the Doctor is pleased to exact? We conceive this to be the most objectionable of all the objectionable measures by which the management of this Institution has been distinguished. It is placing the Institution under the foot of one man; it is destroying utterly its freedom of action; it is making a private speculation of what was meant to rest on the broadest basis of public co-operation and utility.

Notices to Correspondents in our next.

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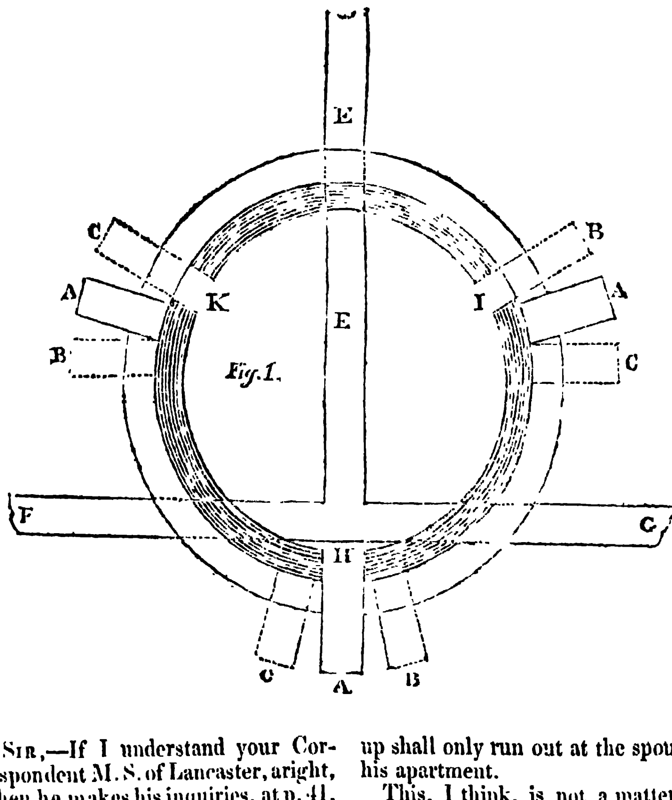
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 69.] SATURDAY, DECEMBER 18, 1824. [Price 3*d*.

"Do not think learning in general is arrived at perfection, or that the knowledge of any particular subject in any science cannot be improved, merely because it has lain five hundred or a thousand years without improvement."—*Watts' Improvement of the Mind.*

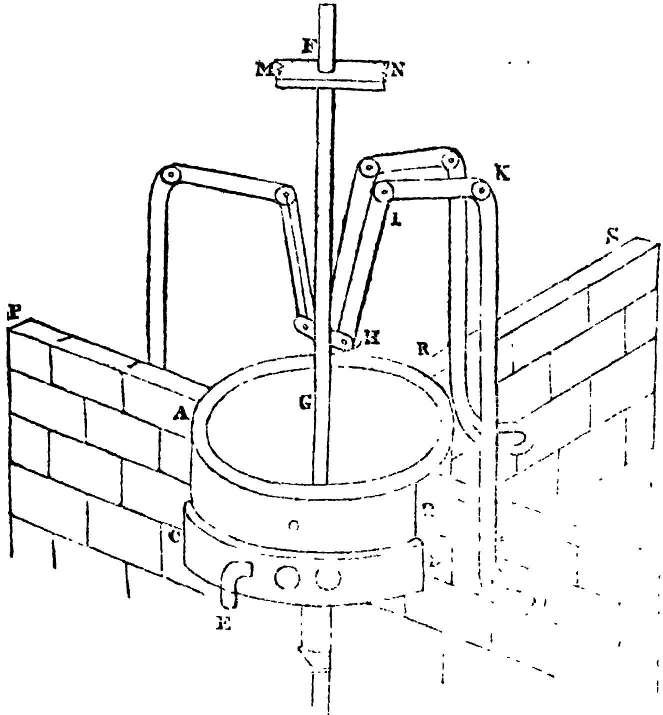
PLAN FOR A TRIPLE PUMP.



SIR,—If I understand your Correspondent M. S. of Lancaster, aright, when he makes his inquiries, at p. 41, vol. III. respecting a Plan for a Pump, it is that of having to supply three adjoining rooms by means of a pump, which must be so constructed, that an individual in any of the rooms shall only pump for himself; or, in other words, that the water pumped up shall only run out at the spout in his apartment.

This, I think, is not a matter of much difficulty; one plan I now send, and have been careful that it shall be as simple as I think the case admits of, and, I believe, perfectly new. If it but furnishes a *hint* to the ingenious workman, my purpose will be fully answered.

PLAN FOR A TRIPLE PUMP.—(*Fig.* 2.)



Description.

Let FG and EE, fig. 1, represent the walls which separate the different apartments; let the shaded circle, HIK, be the cistern, in which three perforations are made where the water is to run from, and let the outermost circle be a ring of metal, to which the spouts are to be affixed in the points AAA: the ring need not be much wider than the diameter of the spouts, and it must nicely fit on the cistern, towards the bottom, as shown at CD, fig. 2, and ought to be ground in the same manner that the plug of a brass cock is; that is, the working surfaces of the cistern and ring must be a portion of a cone. It is then evident, that the water will not run out of the cistern but where the spout corresponds to the hole made in it; thus in the position AAA, it is evident the water will issue only from the spout A through the orifice H. Now, using the spout as a handle, turn the ring round into the position B; the orifice, H, will then be closed, and the spouts will be in the position BBB, and the water will issue through the orifice, I. In the same manner, if we move the spout to C, the water will only issue from K; thus each separate individual in the three rooms can turn the water on in his own room, and, at the same time, shut it off from his neighbour's. It will be evident that a stop must be placed to limit the motion of the spout in the arc BC; and by placing a mark on the cistern, we always know when the spout is in its right place; but this will be only necessary at the spout A, as the stop at D and C will of itself tell when the spout is in its right place.

Figure 2 is a perspective representation of the pump, as fixed, with the working part, &c.; and as all the handles work in a similar manner, it will be only necessary to show one to explain the three. PQ and RS are the two walls that separate the rooms; ABCD, the cistern of the pump, with its ring, CD, and spout E; FG is the piston rod working through a cross bar fixed at MN, thereby keeping itself always perpendicular; HIKL is one handle, IKL is in one piece (a bent lever), working on a centre at K; the piece IH is jointed at I and H to the handle, and the projecting joint fixed to the piston rod at H; each handle is fixed in like manner; and, for the sake of the

more easily working, the handle, KL (as well as all the others), may be made to take off near K, and only fixed when wanted to pump.

Many more methods might have been shown for the working part, but this appears to me the most simple, and, at the same time, the least expensive.

I am, Sir, yours, &c.

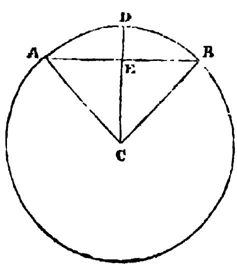
G. A. S.

MECHANICAL GEOMETRY.—NO. III.

(Continued from p. 141.)

THEOREM IV.

If from the centre of any circle a radius be drawn to the circumference, bisecting any chord, it will be perpendicular to the chord.



Let AB be any chord, and let it be bisected (or divided into two equal parts) in the point E, then, if from the centre, C, we draw a line or radius to the circumference at D, and passing through the point E, the radius, CD, will be perpendicular to the chord AB.

For (by Theorem I. Part I.) the line CE standing on the line AB makes the angles AEC and BEC, when added together, equal to two right angles; now draw the line CA and CB, which, as they are radii to the same circle, are equal to each other (by Definition III. Part II.), then we shall have two triangles, AEC and BEC, whose sides are all equal each to its corresponding one, that is, AE equal to BE, CA equal to CB, and the side EC belongs to both triangles; and hence, if these triangles are laid on each other, they will correspond in every respect, or will be identical triangles, and the angles will also correspond; hence we shall find the angle AEC of the triangle AEC will correspond to the angle BEC of the triangle BEC, that is, they will be equal. But we have shown that the angle AEC added to the angle BEC is equal to 180 degrees, or two right angles; hence either of them will be equal to the half of 180 degrees (or 90 degrees), which is the angle of a right angle. Thus DEC is perpendicular to AEB.

COROLLARY 1.—Hence the converse of this Theorem, viz. that if any radius is perpendicular to a chord, it divides that chord into two equal parts, or it bisects it.

COROLLARY 2.—Hence also we see that when any radius bisects a chord, it also bisects the arc of that chord; that is, if CD bisects AB, it will divide the arc ADB into two equal parts; that is, AD and DB will be equal to each other.

COROLLARY 3.—We also see, by this Theorem, that when two triangles have their sides severally equal to each other, their angles will be severally equal to each other.

COROLLARY 4.—Hence we have also the method of bisecting any angle; for if, at the angular point C, we draw an arc, ADB, and bisect its chord in E; if we draw from C, through E, a straight line, it will bisect the arc ADB, and consequently the angle ACB, which is measured by the arc ADB.

G. A. S.

(To be continued.)

SAFETY FOR THE DEAD.

SIR,—Without resorting to denonating powder, for the purpose of blowing up resurrection men (though, by-the-bye, it would be well to blow up the whole of them), give me leave to inform your Correspondent T. P. A. there is one direct and simple means of protecting bodies from the fangs of those depraved monsters; and that is, by placing the coffin at least seven feet from the surface of the earth. When this is done, there is no occasion for patent coffins, detonating powder, or other securities; they are then out of reach.

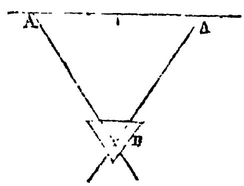
Your Correspondent is incorrect in stating, "that bodies that have been buried a fortnight or three weeks are no longer objects of theft; for bodies that have been buried more than double that

length of time are frequently brought to the dissecting-rooms, to the cost of many incautious and daring students of anatomy.

A MEDICAL READER OF YOUR USEFUL PUBLICATION.

EXPANSION OF PENDULUM RODS.

SIR,—You will oblige me by inserting the following design in your useful Magazine; it is intended to obviate the difficulty arising from the expansion of pendulum rods.



In the plan here represented, AA are the two points of suspension for the pendulum rods, and B the pendulum weight; CC, the ends of the pendulum rods. In B there are two holes in the directions AC, AC, sufficiently large to admit the pendulum rods to move freely. Now it appears to me, that the weight, B, would neither rise nor fall by any increase in the length of the rods AC, AC; consequently the rate of the pendulum would be *uniform*.

The space occupied by such a pendulum might be too great for a common Dutch clock, but I have seen some eight-day clocks where, I conceive, such a pendulum would be used to advantage. Should any of your readers try the plan, they would oblige me by inserting their results in your Magazine.

I am, Sir,
Your obedient servant,
SIMON.

MAN-MILLINERS.

SIR,—Having lately been travelling through France, I observed that, in the management of their shops, the French have a great many excellent customs, which we might copy with advantage. The one, in particular, to which I wish to call the attention of my brother mechanics, is the greater employment which is given to women. In England we exclude females from almost every employment, and from some, in particular, to which they are much better adapted than men. All our shops at which haberdashery, lace, feathers, and such like light and fancy articles, are sold, are served by men. I have often felt quite ashamed to see a great tall, stout fellow standing behind the counter, and serving out ribbons and tape. In France this is considered as the business of the women, and I think with great propriety; for the very expression, *Man-milliner*, implies a sort of nondescript animal, and is a reproach to a *man*. In the same manner, in France, women are often employed in all kinds of shops in the capacity of clerks. Why should not a woman who is a good accountant make a good clerk? The wife of a friend of mine, who has a large shop at Paris, keeps all the accounts; and a better, and, I may add, a prettier clerk I never saw. When we consider that the number of women brought into the world equals the number of men, is it not right that all employments which are suitable to them should be kept free of intruders? I put it to the good sense, not to say the gallantry, of my brother mechanics, whether it is proper to exclude the weaker sex from such employments; and whether it would not be for the benefit of all parties, that there should be more women-milliners and fewer man-milliners?

I am, Sir, &c.
A FRIEND TO THE FAIR SEX.

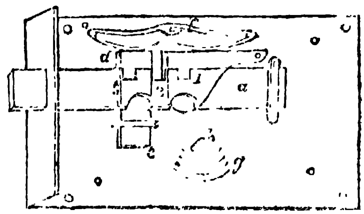
ELLINGTON'S LOCK.

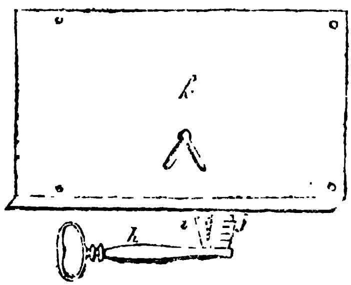
SIR,—As you thought proper to insert my *exposé* of Ellington's Lock (see my letter signed T. J. of the 2nd of last month), I now beg to observe, that Mr. Sparrow is mistaken in stating that "there is not, nor ever was, such a man in the lock trade at Wolverhampton as Mr. Ellington;" because I know the man, and have done so for at least twenty years. He is not much known, certainly; and, as I before observed, the lock has neither novelty nor security to recommend it to notice.

I am, Sir, your humble servant,
SAMOHT NADROJ.

Hammersmith, Dec. 1, 1824.

IMPROVED LOCK.





Sir,—I herewith send you a Drawing and Description of a Lock which I lately invented, and which, if you think them deserving a place in your Magazine, are much at your service.

I am, Sir,
Your obedient servant,
W. S.

Messingham, near Brigg,
Lincolnshire.

Description.

a is the bolt; *b*, the pivot upon which the key turns; *c*, the tumbler; *d*, a securing bolt; *e*, the end upon which the key acts; *f*, a double spring to push down the tumbler and securing bolt; *g*, wards; *h*, the key, with a double web placed at something less than a right angle; 1, 2, 3, notches in the bolt, with corresponding teeth in the tumbler and securing bolt to fall in, &c. The lock in the drawing is represented as locked; the process of opening will be as follows:—The first web of the key must have a bit taken out, as at *j*, to pass over the end, *e*, of the securing bolt without touching it; the tumbler must either be made thicker, or placed at a small distance from the back plate, by which means the key will act upon it as if no part had been taken out, and consequently lift the tooth of the tumbler out of notch 1. At this position the second web of the key must come in contact with the end, *e*, of the securing bolt, and lift its tooth from the notch 3. The bolt will then, by the revolution of the key, be pushed backward, and the tooth of the tumbler will fall into notch 2; the second web of the key will then lift the tumbler; and as there is no notch for the securing bolt, it will again be pushed back, and the tooth of the tumbler will fall into notch 3; thus it will be completely unlocked: *k* is the front plate removed, to shew the internal construction of the lock, &c.

This lock will be difficult to pick, from the circumstance that the securing bolt and the tumbler want lifting, and the bolt shooting at the same moment of time. Should any of your mechanical readers make locks upon this principle, or any improvement thereof, I must request they will, through the medium of your Magazine, communicate their practice or improvement to the public.

OIL FOR WATCHMAKERS.

Sir,—Seeing, in your excellent Magazine, an inquiry for the best method of procuring the finest Oil for Watchmakers, I have great pleasure in informing you of the most

simple and certain method of purifying olive oil, and which I have seen tried with great success by Dr. Nooth, F. R. S.

Put the oil into a white glass bottle, hang it up in a window exposed to the sun; in two or three months it will be as clear and white as water, all the impurities being thrown to the bottom. The bottle in which the experiment was tried was square, and it was remarkable, that the sediment did not settle regularly to the bottom, but seemed thrown into the four corners.

I propose trying this experiment next summer with whale oil for lamps, and will let you know the result.

I am, Sir,

Your obedient servant,

H. M. VAVASOUR.

Melbourne Hall, Dec. 3.

P. S. Some of the purified oil was given to a watchmaker at Bath, who highly approved of it.

THE SCREW QUESTION.

SIR,—It appears to me that your screw-driving controversialists have failed in "driving" their argument "home." I do not see how the power gained by lengthening the instrument can be accounted for, except by considering the screw-driver as a lever of the fourth order. By the crooked lever, in short, supposing the form could conveniently be used, it is evident you would gain power in proportion as you increased the length of the handle. According to this idea, the power gained will be in the proportion borne by the longer limb, the handle, to the shorter one, the breadth of the point.

I am, Sir, yours, &c.

TURN-SCREW.

December 8th, 1824.

P. S. It is quite mournful to read the direful consequences predicted by my relation "Screw" from the use of too short a tool. I heartily trust this worthy gentleman will escape all the horrors of a mutilated cloven head, disfigured face, &c. (in which I am sure Mrs. Screw will heartily join), and will return to his "bed" untorn and undefaced. T. S.

SIR,—I shall feel much obliged by your permitting me to correct an error in my former letter (page 152), which I fear may occasion ambiguity. Instead of the passage beginning in the fourth line from the bottom of the page, I should wish to substitute the following:—"The same distance being observed for the small end of the tool as before, and the usual distance for the diameter of the handle."

In addition I may remark, that it is usual to make a considerable difference in the size of the handles; and if the screw-driver be considered as composed of two levers, every difference becomes doubled.

I remain, Sir,

Your very obedient servant,

Dec. 6th, 1824. F.

P. S. I am sorry Mr. Nichol Dixon has deferred giving his ideas on the subject, but must say, that until a better method is given, I shall be content to measure the power of the screw-driver by the means I before alluded to. Does Mr. N. D. think a screw-driver made sufficiently strong to prevent elasticity would suffer any diminution of power? or does he, or any other of your Correspondents, think that a smaller handle would not produce that effect?

LONDON IMPROVEMENTS.

SIR,—Your Correspondent "A." (whom I shrewdly suspect to be one of the unfortunate proprietors of Waterloo Bridge) having suggested opening a spacious street from the said bridge to Tottenham Court Road, as an object much wanted, I will, by your leave, point out one of still greater utility to the public, the want of which is severely felt; and which I often wonder has never been executed, namely, opening a street from the end of Coventry-street into Holborn. There are an immense number of carriages now obliged to wind along the present narrow, cir-

cuitous, and dangerous streets in this neighbourhood, to their very great danger and inconvenience, to arrive at either of these points. Now, by attending to the map, it does not appear that it would be necessary to take down so great a number of houses as might be expected. By breaking through into Leicester-square, the line would pass along the north side of that square, whence an opening would be necessary to Long Acre, which would make a continuation of the line. On crossing Drury-lane it would be requisite to take down a few houses to avoid the double turn into Great Queen-street, which would form another continuation; from the east end of which an oblique opening would be wanted into Holborn, leaving Lincoln's Inn Fields to the right, and entering Holborn opposite Red Lion-street. This line of street would be of the greatest convenience to the western coaches on leaving the city, and particularly for the mails from the new Post Office. What public buildings or embellishments might be introduced into this street (which might not inaptly be called Great Union-street) I will leave to the architect to suggest, as being more within his province. I have merely studied utility, and I do hope, ere long, to see something of the sort carried into effect.

I am, Sir,
Your humble servant,
T. J.

Hammersmith.

PYROLIGNEOUS ACID.

Sir,—I observe, in your 56th Number, an answer to S. E.'s question, that this acid may be purchased at any chemist's shop. Give me leave to say that I am apprehensive the "Bacon-fed Chuff" may have called the acid which he uses by a wrong name. When the rough acid is purified, it is called concentrated; but in this state it is freed from the fragrant smoky flavour so much admired in bacon, and which the rough acid is calculated to impart. There may be an intermediate sort, called the *rough* or *partly* concentrated; but if he were to mention the price he pays for the article, it might solve the difficulty. The rough acid may be bought for 2*s.* 6*d.* per gallon, whereas the concentrated is 2*s.* per pint, which is a great difference. I therefore suppose he means the *rough*.

I am, Sir, yours, &c.
A Country Reader.

STRENGTH OF LEATHER — FORCE AND VELOCITY OF HAMMERS.

Sir,—Various engagements have prevented me, hitherto, from replying to the questions in your 65th Number, page 141.

First, to A. B. C., respecting my experiments on Leather, I beg to observe, that the pieces subjected to my experiments were short, varying from seven to fourteen inches in length; about two inches at each end were occupied by the vices made use of in the experiment; the extension in all the specimens appeared most towards the centre of the pieces, producing in that part a proportionate contraction in width and thickness. I think it very probable that the mode of attaching the vices to the leather prevented the contraction near the ends, which otherwise would have taken place.

Second—Some of the fractures took place through the whole substance nearly at the same time, whilst others commenced on one side, in consequence of the resultant of the force not perfectly coinciding with the centre of the straps, although care was taken to make this coincidence as near as could be, and probably nearer than in the common use of leather straps will be found to be the case. One of the specimens of cow-hide was a little cut by the vice, and began to separate partially. I am aware that if the straining force be applied to one side of a broad strap, it will be torn with less force than if all the parts of the substance are allowed to act together, just as we tear a sheet of paper by beginning at one edge.

Third—I did not measure the degree of *elasticity* in the course of

my experiments. I am aware that it would be of some importance to determine the elasticity, and had there been any considerable share of this quality visible, I should have done so; but I soon perceived the proper elasticity to be very small, and that whatever extension was produced by the weights nearly remained after the weights were removed. I also observed that many of the specimens suffered a considerable extension before they became sensibly impaired in strength.

In reply to your Correspondent relative to my experiments on the Force and Velocity of Hammers, I beg to observe that I used them of various weights, from five to fifty-two ounces, and also a two-handed beetle of twelve and a quarter pounds weight. My object was to ascertain the *greatest* force or velocity obtainable without extraordinary exertion.

The following list exhibits the weight, including the handles of some of the hammers tried, and the velocities observed:—

Lbs.		Feet per sec.
0.30	iron	59.5
0.68	iron	57.0
0.406	iron, short handle	36.0
0.87	wood	50.0
2.83	wood	56.0
3.52	iron, short handle	46.0
12.25	wood, two-handed	38.0

I afterwards tried the effect of different lengths of handle to the same hammer, the head being of iron, and weighing one pound.

	Inches.		Seconds.
Length of handle	42	Velocity	53
	36		54
	30		55
	24		57
	18		61
	12		64

The above being the *greatest* velocities, and as the least velocities may be any thing above eight feet per second, the medium may probably be not far from what I have given in my former letter. I find Dr. Young quotes Professor Robison in a note, and mentions twenty-five feet as the velocity of a carpenter's hammer; but the page or article is not referred to; if any of your readers can point out the place, perhaps something more interesting may be found.

I am, Sir,

Your obedient servant,

B. Bevan.

Leighton, Dec. 7, 1824.

SINGULAR EFFECT OF PRESSURE.

Sir,—I observed, a few days back, in the brewhouse of John Nealds, Esq. at Guildford, that the slightest pressure of the thumb on the head of the barrels of ale or beer, whilst working off the yeast, caused it to rush out, more or less, according to the pressure. Now, though the head of a cask of that description is at least inch and a half oak, yet the effect is as great as if it were a drum-head. I beg to know if any of your intelligent readers can explain the reason of the above-mentioned *action*; there being a diversity of conjectures on the subject, and a desire to promote scientific observations, will, I hope, plead my excuse for troubling you.

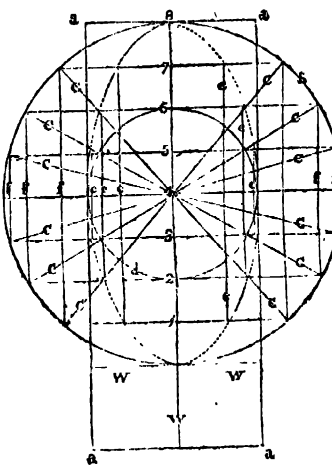
I am, Sir,

Your obedient servant,

J. W.

104, High Holborn,
Nov. 16, 1824.

CAUSE OF SOME STEAM-ENGINES REQUIRING MORE FUEL, OR USING MORE STEAM, THAN OTHERS, ALTHOUGH DOING THE SAME WORK.



Sir,—A few days ago, I happened to see two steam-engines at work near each other; the one was the improved double reversing steam-engine, the other a continuous rotatory steam-engine: this last was doing the most work, yet not consuming half the quantity of coal as the reversing engine. This led me to consider the cause, which may be understood by the following description of the properties of the reversing engine, as it communicates its power to machinery by means of a crank. (See the prefixed drawing.)

Description.

aaaa Represent the inside section of a steam-engine cylinder, two feet in diameter and five feet in length, adapted to give a four-feet stroke; *bb*, a circle of four feet in diameter, agreeing with the length of the crank. The perpendicular diameter of this circle is divided into eight equal parts, as shown by 1, 2, 3, 4, 5, 6, 7, 8; through each of these parts lines are drawn at right angles to the perpendicular, until they intersect the circle *bb*. From each of these intersections lines are drawn to the centre of the circle *bb*, shown by *cc*. From the same centre is drawn the circle *dd*, equal to the diameter of the cylinder, *aaaa*. Through the places where the lines, *cccc*, intersect the circle, *dd*, are drawn perpendicular lines, *eeee*; perpendicular lines are also drawn in the crank circle shown by *ffff*. Hence it is evident, that the lines indicated by *e* have the same proportion to the oval formed within the cylinder, *aaaa*, as the lines *ffff*, which are contained in the crank circle, to the circle *bb*. The intersection of the lines marked *e* with the lines 1, 2, 3, 5, 6, and 7, gives the definition of the oval in the cylinder, which shows the distinction between the effectual and ineffectual portion of steam which must be used by the reversing engine to give a rotatory motion by the means of a crank. The part of the oblong figure, *aaaa*, outside of the oval, shows the quantity of steam used in the reversing engine, *more than* that which would produce the same effect, in case the power was applied continuously and directly, and not reciprocally; I have therefore taken the liberty of terming it ineffectual (use of) steam. The parts of the cylinder, *www*, show the ineffectual portion of steam used, which is contained above and below the piston, together with the side branches, nozzles, &c. which is unavoidable. Hence it follows (in round numbers), that the best reversing (crank-working) steam-engines use about nine parts of ineffectual to eleven parts of effectual steam.

I am, Sir,

Your obedient servant,

A Lover of Improvements.

STEAM NAVIGATION.

SIR,—The Steam Vessels referred to by your Correspondent "G. Bayley," as having come under his observation, must indeed be badly constructed—if, as he states, the "paddle-wheels have so insufficient a hold of the water, that they drive it aft to such a degree that it runs under the quarter at the rate of eleven to twelve knots per hour, while the real progress of the vessel is but six or seven knots, showing a loss of nearly fifty per cent." *

From what vessels G. B. has drawn these conclusions I cannot judge; certainly not from any of those plying on the Thames; for, in reference to them, his statement is incorrect, as the performance of the following vessels will show:—

	Vel. of pad. wheel.	Speed of boat.	Difference.
Eclipse - - -	10.25 knots per hour - - -	7.3 knots - - -	2.95 knots.
Albion - - -	10.85 knots per hour - - -	8.8 knots - - -	2.77 knots.
Venus - - -	10.55 knots per hour - - -	7.8 knots - - -	2.75 knots.

Here, then, the mean difference between extreme circumference of wheel and boat is only 2.82 per hour, or the portion lost in driving the water aft. Several other examples might be quoted, and the result would be found nearly the same.

I apprehend, with the present construction of paddle-wheels, this difference cannot be materially lessened without at the same time affecting the velocity of the boat.

The immersion of the floats ought to be calculated so as to absorb the power of the engine at its regular speed.

The position assumed by G. B.—"That the wheels of a steam vessel ought to be considered as a pinion working into a rack, and that the strength of the rack is but in proportion to the cubical contents between the floats"—does not apply; for, were they placed at five and six feet apart, as he suggests, in some diameters of wheels, one float would be entirely out of the water before the next one had entered it, causing great irregularity in the working of the engine, besides loss of power.

I am of opinion that the best effect is likely to be produced when the wheels have a float for every foot they are in diameter, and the surface brought into action each moment of time should bear a certain proportion to the immersed section of the midship bend.

HORATIO.

Tower, Dec. 7, 1824.

* No. 63, page 108.

CURE OF DRY ROT.

SIR,—Your valuable publication being the medium by which various specifics and causes of the Dry Rot have been stated at different periods, and the subject being one of infinite importance to our naval greatness, I beg leave to offer a few remarks, which I hope will induce your abler Correspondents again to investigate the subject. Mr. Burridge, in his treatise on Dry Rot, gives winter-felling of timber as *its* only cure. Now, as the adoption of his method would destroy the bark, and thus enhance the price of oak timber itself, I wish to be informed the reason why American oak, which *is always felled in winter*, is peculiarly susceptible of the disease when it is used in the construction of British ships? I consider the dry rot in British oak timber to arise, more or less, from the nature of the soil in which it grows; as we find that Welsh oak by no means equals in duration Hampshire growths, although both are apparently good. The dry rot, at the conclusion of the last war, had attained its greatest height in the British navy; the disease was then created and nourished by the pernicious practice of building ships from various descriptions of timber; American, Baltic, and British oak being mixed with pine, elm, and ash, the various juices of which, on being closed up, produce a chemical action, and cause what we denominate dry rot. This is evident from each of the above sorts of timber, when used alone in ship-building,

producing a good and lasting vessel. Look at, for instance, the pine ships of Norway and Sweden, the oak ships of Holland, &c. As a remedy for this evil, I would recommend the discontinuance of the practice of using various sorts of timber in the same ship; and that when the vessel is on the stocks, all between the timbers should be filled with salt, which effectually prevents vermin, and, by destroying any living principle in the timber, eradicates dry rot. The national and mercantile navy of the United States of America have long used salt with the greatest advantage, and I have seen several ships so treated open perfectly sound. The first apparent objection to the use of salt is the creation of damp; but an inspection of the American packet ships at Liverpool, or elsewhere, will remove any prejudice on that head. Several American captains have informed me, that the use of salt in their ships is productive of no inconvenience. I intend giving salt a fair trial, as a cheap remedy to prevent decay in ships, and recommend the subject to others.

I am, Sir,
Your obedient servant,
A SHIP-OWNER.

Dublin.

NEW TALLOW LAMP.

SIR,—In perusing your Magazine, I find the description of some very curious lamps. Now, it strikes me, that if lamps were constructed to burn tallow, instead of oil, the light would be greater, and the smoke and smell imperceptible, compared with what is produced by oil. I have in my possession, and of my own inventing, one of this description, which I call a Tallow Lamp. It is constructed of brass, somewhat in the shape of a common candlestick, and is more portable and safe than a candle. When trimmed according to my directions, it will be found equal to four candles, of six to the pound, and will burn with a steady light, without snuffing, &c. for three hours. The degree of light is regulated by turning a small cock or screw with the finger and thumb, when the light is instantly made larger or smaller, and suitable to any purpose. I have used this lamp to solder with ever since I made it, and find that large and small articles may be soldered with pleasure; spirits may also be evaporated, eggs cooked, and silver, gold, or brass, melted by it. One pound of tallow and three inches of wick will light up one of my lamps for six nights, burning three hours each night.

I am, Sir, &c.
M. MONNOM, watchmaker.
Broadway, Worcestershire.

[We shall be glad to receive a more particular description of the construction of this apparently useful Lamp, and a statement, founded on the inventor's experience, of its economy compared with candles.—ED.]

UNION OF COPPER WITH IRON, ETC. BY MR. P. N. JOHNSON, MINERALOGIST AND ASSAYER.

The Combination of Copper with Iron, although stated by many writers on metallurgy to be capable of uniting in an *indirect* way, is yet by most operative men, as casters of copper and others, positively denied to have any such capacity.

I have had my attention directed to this subject, by being summoned as an evidence in a cause Smith *v.* Frost. Mr. Smith, who uses copper pans to boil the ingredients for making a green pigment for painting and dyeing, had been recommended to make use of cast pans to save the expense of wrought ones, but these not answering his purpose, he employed me to inspect and give my opinion on them. In my experiments I proved the presence of tin and iron; the latter was in a very minute quantity: but from the proportion of the former the contract was supposed to be void. The opposite party, however, being coppersmiths or casters, positively asserted the impossibility of the union of copper and iron; and finding, on inquiring of several persons in the same way of business, that a similar opinion generally prevailed, I resolved on making some experiments to

prove how far it was possible to unite these metals.

I first mixed 100 parts of copper with two of iron, covering them with rosin, and filling the crucible with powdered charcoal. After being exposed to about 90° of Wedgwood's thermometer for a quarter of an hour, the mixture gave a clean lump of copper not quite so malleable as when unadulterated, and with a redder grain. I then endeavoured to ascertain how much iron the copper would take up, by covering 400 grains of pure copper with iron filings, and filling the crucible as before. The produce was 880 grains, of a large red grain, bubbled in the inside as if occasioned by confined air, with a clean uneven surface, and possessing nearly the malleability of zinc.

The next thing was to prove the existence of the iron by the usual process of analysis. The increased weight, indeed, clearly proved its presence; but I thought the analysis necessary, to prove that only the iron had entered into the composition. As the iron I had used for the foregoing experiments was slightly oxidated, I fancied this might have facilitated the union. I therefore subjected 400 grains of copper covered with black oxide of iron (the crucible filled with charcoal) to a strong degree of heat for half an hour. The produce was 526 grains of copper remarkably red, which, on analysis, nearly answered to the increased weight as metallic iron. I consider the iron to have been the cause of the copper having such a red appearance, from its partially oxidating it: it may perhaps, too, have had the effect of making it more brittle, by separating the particles of metallic copper. I further ascertained that this oxidation greatly facilitated the combination. Having melted 400 grains of pure copper with a clean bit of thick iron wire, taking care to cover the crucible well, as in the former experiments, the produce was a lump of copper, in the heart of which a bead of steel (containing a proportion of copper) was found enclosed, with some loose bits of steel, on the surface of which a few grains of bad copper were to be perceived. The copper was very malleable, but not so much so as when unadulterated, and containing only $4\frac{1}{2}$ per cent. of iron.

The formation of the steel may, of course, be accounted for by the crucible being filled with charcoal, to prevent the oxidation of the copper.

Although the union of these two metals is certainly not so perfect as that of other metals, yet I trust that those who credit these simple experiments will abandon the prejudice of there being any impossibility in their combination. For my own satisfaction, I have made several experiments in uniting copper with other metals; and perhaps you may consider them sufficiently interesting to give them also a place in your pages. What more particularly struck my attention, was the effect of arsenic when melted with copper. It altered the colour without increasing the weight of the copper, being no doubt volatilized.

United with the two hundredth parts of arsenic, the copper was rendered whiter, softer, and more ductile, but not increased in weight. United with ten hundredth parts of arsenic, the copper, as in the former case, was not increased in weight, but became very white, and not quite so malleable.

It may be necessary, however, to observe, that I used the glass or oxide of arsenic, which might have facilitated its evolution; although, as the crucibles were filled with charcoal dust, I thought this would have prevented any such effect.

Copper united with two hundredth parts of tin was rendered less malleable, became of a flaky bright when suddenly flattened by hammering, was smooth in the fracture, and had a colour inclining to yellow, and somewhat whitened.

Copper united with two hundredth parts of lead assumed a bright flaky appearance when hammered, and the malleability was much diminished.

Copper united with two hundredth parts of zinc was rendered softer and less ductile, but not so flaky as when united with either tin or lead: the fracture was of a dirty red colour.

ROLLING MILL.

SIR,—I addressed you on the 16th of April, in reply to some of your inquirers, with a communication that, in this neighbourhood, there is a Rolling Mill where they manufacture lead of a superior quality, for the prevention of damp in walls of rooms. Since then I have found, in perusing your valuable Magazine, other inquiries to the same purport, which has induced me to forward to you samples of the lead for the above purpose, that you may be enabled to show the said samples to any of your numerous Correspondents or friends that will take the trouble to call upon you. It may not be unnecessary, therefore, to point out the advantages of this lead. As soon as it is nailed on to the wall, the place may be instantly repapered or painted; when any alteration is made in a room, such as stopping up any door or window, or the breaking out of others, it takes, according to the ordinary method, a considerable time before the lime is sufficiently dry to admit the room being finished, but, by applying the remedy here proposed, the damp is effectually prevented, and the room may be finished, either by painting or papering, without any loss of time.

I am apt to think, were it more generally known, it would be a valuable article to painters and paper-hangers, and to those who wish to have a good room without being annoyed with damp. The manufacturers are Messrs. Hutchinson and Co., Rolling Mill Company, Pately Bridge, Yorkshire.

I remain, Sir,
Your obedient servant,
J. W.

[The samples alluded to may be seen on application at No. 55, Paternoster Row.—*Edit.*]

TUNNELLING.

SIR,—I am the person who, on the day the Thames Tunnel Company announced their first meeting, inserted an advertisement in the *Times* paper, stating I had matured a plan for effecting the completion of the tunnel unsuccessfully attempted under the Thames at Rotherhithe, projected by the late Mr. Dodd, or any other tunnel which might be required under the Thames, or any other river. At the time of my inserting this advertisement I resided in the country, and had not seen your Magazine, nor did I know that the undertaking of any other tunnel was contemplated.

The idea of accomplishing this undertaking first struck me, when, in under-draining the town I then occupied, I had occasion to carry a deep drain under a considerable stream of water. Knowing the only survivor of the men who were employed in conducting the excavation of the first projected tunnel, I was acquainted with the cause of its failure. Confident in the superiority of my plan over any that I have since seen announced to the public, I proposed taking out a patent; but the effect of an unfortunate lawsuit, in which I was then engaged, prevented me from pursuing my design. The disastrous consequences that attended my lawsuit have deprived me of the means of obtaining a patent. My motive for addressing this communication is, to express my wish to avail myself of the co-operation of some respectable Engineer to join me in accomplishing my object. My plan is original, and has this superiority over others—no failure can possibly take place. It will effect the grand desideratum, that of allowing the crown of the arch to be nearly level with the bed of the river; consequently the great objection to a tunnel will be avoided, that of a great acclivity and declivity, and the approaches will be consequently contracted.

Should any Gentleman feel inclined to obtain further information on this subject, I shall be happy to wait upon him. I must beg to observe, that though a man possess a small share of learning, he may be capable of conveying some useful thoughts, or of making some useful discovery, or by chance acquire some secret of nature, or some useful intelligence of facts, of which more enlightened men may be ignorant; the advantage of which may be lost to themselves, and their utility to the public, from a want of patronage and assistance.

A STAFFORDSHIRE LAND-DRAINER.

"ART OF WEAVING."

While almost every art connected with the cotton manufactures of Great Britain has had its principles investigated, and details minutely explained, by scientific men, the Art of Weaving, to which they all refer, and which may be said to be the foundation of the whole, has hitherto been left in the hands of

the mere artisan, whose limited means and education necessarily exclude him from offering such a development of its principles, and classification of its different branches, as the importance of the subject, both in a national and scientific point of view, obviously deserves.

We are happy, therefore, to have it in our power to announce to the manufacturing interest, that this desideratum has now been ably supplied by the labour and ingenuity of Mr. John Murphy, of Glasgow, who has devoted much of his time and attention to the subject, and given to the world, under the above title, a work replete with sound views of the principles of this interesting art, and with illustrations of its details, not only by clear descriptions in writing, but by a series of engraved diagrams, explanatory of the various textures of cloth and of the apparatus employed in their production, from the graver of Mr. Maclure.

We have space, at present, only for this short notice of the work; but we may be induced, in another number, to offer a more detailed account of it, and to support our opinion of its merits by a few extracts.

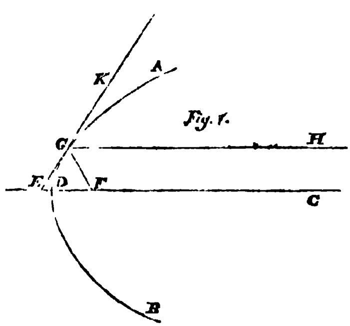
ANSWER TO INQUIRY.

NO. 61.—CONSTRUCTING REFLECTING TELESCOPES.

Sir,—Your insertion of my "Solution of the Geometrical Exercise," induces me to trouble you again.

It is likely that several of your more able Correspondents have already endeavoured to supply Mr. Barton's numerous wants (specified page 30, Number 61) respecting the manufacture of Specula for Reflecting Telescopes. If, however, you have not yet received a communication better adapted for explaining to Mr. Barton, "Why a parabolic curve is necessary for the large speculum, and why a spherical curve would not do as well," you are at liberty to insert the following.

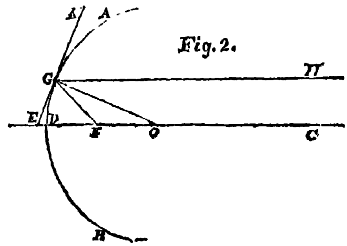
One of the fundamental laws of optics may, in reference to curve surfaces, be put into this form:—*In the reflection of light, the incident and reflected rays form equal angles with a tangent to the curve at the point of incidence.*



Let ADB (fig. 1) be a central section of a speculum perfectly parabolic, of which CD is the axis, D the vertex, and F the focus. Since, from the nature of the parabola, every diameter, GH, and its focal chord, GF, make equal angles with the tangent, KGE, drawn through its vertex, G, every pencil of rays, HG, parallel to the axis, CD (which, according to the law specified above, is always reflected in the direction GF, so that the angle FGE equal HGK), meets CD, after reflection, in the same point, F, the focus of the paraboloid; consequently there

is no aberration of rays, that is, no confusion of images, at the focus of a perfectly parabolic speculum. The image which is there formed of an object indefinitely distant is *perfect*, depending for distinctness* conjointly upon the magnitude of the speculum and its reflective power.

Fig. 2.



The case is very different with the spherical speculum. In this case, AB (fig. 2) being a central section of the speculum, of which CD is the axis, D the vertex, and O the centre, it is evident that any pencil of rays, HG, parallel to the axis (reflected, according to the fundamental law, in the direction GF, so that the angle FGE equal HGK) meets CD, after reflection, in a point, F, which always bisects OE. And since OE increases according as the point G recedes from the vertex D, the point F must advance outwards from its limit, the bisection of the radius, OD, till the angle, DOG, becomes 60°; beyond which, of course, single reflection, so as to meet the axis, ceases. In a spherical speculum, therefore, all the pencils of rays coming from an indefinitely distant object, which are reflected from the circumference of any given circle whose centre is D, meet at a point of the axis peculiar to themselves; that is, every cone of reflected rays has its vertex in a different point of the axis between the limit of the point F and D. This occasions the *aberration* of a spherical reflector. A succession of images is thus formed, less perfectly blended as the point F recedes from its limit nearest to O; consequently no perfect image whatever can be formed by parallel rays reflected from a spherical surface. The confused image, however, which is formed, approaches perfection in proportion as the angle, DOG, is diminished. Hence Mr. Barton will readily perceive, that of specula formed of the same materials, and containing the same quantity of reflecting surface, that is the best which is a portion of the largest sphere.

I am, Sir,

Your most obedient servant,

NATHAN SHORT.

* In specula which have the same focal distance.

INQUIRIES.

NO. 80.—STRENGTH OF ROPES.

SIR,—I shall be much obliged to any of your Correspondents who will communicate where the most correct information is to be found respecting the actual and comparative Strength of Ropes?

I am, Sir, &c.

T. S.

NO. 81.—CLEANING SILVER PLATE.

SIR,—What is the best method of taking tarnish off Silver and Plated Goods? The usual method followed here is by polishing, but this is very injurious to plated articles, especially to chased or wrought work, &c.

I am, Sir,

Yours respectfully,

S. B.

Edinburgh, October 20, 1824.

NO. 82.—WHITENING BRASS WORK.

SIR,—In the process of Whitening Brass Work by boiling, what is the best method of preparing the tin, and the best ingredients to be used?

And is there any method of boiling brass work white by a preparation of silver? S. B.

NO. 83.—JOINT EFFECTS OF CONDENSED AIR AND GUNPOWDER.

SIR,—There is, in page 217 of the first volume of the Mechanics' Magazine, a plan for a bomb to be fired without a fuse, which is accomplished by heat given out by common air, on being suddenly *condensed* by a blow on the plug. I should wish to ask the opinion of some one more conversant with the properties of air than myself, whether, if a body of closely condensed air were allowed suddenly to exert its whole force, in *expansion*, on a quantity of gunpowder in a confined situation, it would not answer the same end?

The manner in which the effect is most proper to be tried appears to be by the air-gun, in which, after being charged with air, a quantity of powder (suppose the usual charge) may be placed between the roller or stop-cock and the bullet. Hence arises another question, viz. supposing the powder will explode, whether the velocity of the ball will be equal (by the united action of the air and powder) to the velocity it would acquire by their actions added together? As I may, perhaps, be more clearly understood if I say, suppose the velocity by air as one, and by powder as one, whether, when combined, it will be equal to two? Or, if not so much, to what the diminution may be attributed?

F. H.

Percy-street, St. Pancras.

NO. 84.—WATER WHEELS.

SIR,—A Water Wheel is required for a weak stream, the whole fall being thirteen feet; I wish to know which description of wheel will produce the greatest effect? and if an overshot will, what height of head is necessary above the wheel? Or if the wheel called by some a tumbler, by others a balance-wheel, what ought to be its height? I should also be glad to know, in either case, what is the proper velocity? also what is the increase of expense and of effect by substituting iron buckets for wood?

A SUBSCRIBER.

NO. 85.—VITREOUS STONE-WARE.

A Young Country Potter would feel highly obliged to any of our Correspondents that would give any information respecting the composition and process of making the Vitreous Stone-ware Bottles and Jars, with the manner of burning and glazing them?

CORRESPONDENCE.

A Correspondent, alluding to Inquiry No. 78, respecting the calculation of Running Water, observes, that he has "often seen the defect of rules for this purpose, and is led to believe, that no correct rule can be given to suit all circumstances, at least not without paying some attention to the state of the atmosphere at the time. The atmospheric pressure on the surface of the water varies one-fifteenth ordinarily, sometimes considerably more. He imagines this must affect the flow of the water at any depth, and that the difference must be the most nearest the surface."

Philo-Mechanicus wishes to know, whether the improvements on Chronometers, by H. G. Dyar (mentioned in pages 382 and 412, vol. I. of the Mechanics' Magazine), are yet introduced into England, and sold? And if so, where and at what places they can be procured?

G. N. D. and other Inquirers, are informed that the Supplement, containing the Index, &c. was published at the beginning of this month, and may be had by application at our Publishers'.

Communications received from--W.B.B. —Thomas Whiting—Dixon Vallence—A. W. S.

HS. MS. J. B. B.—C. N.—G. F.—John Wolrab—W. A.—L. G.—B.—T. Porter—J. S.—D.—Junius—G. Thurnell—N. Spence—Scrutator—An Old Friend—M. D.—One Pound One—Q. X.—Rem. —W. Pond—A Reader in Leicester—Spyglass—Unit—P. P.—Mechanics' Friend—P. A—Touchstone—T. M. B.—Everybody—Jack Horner—Aaa.—Speculator—John Young—H. T. F. Dice.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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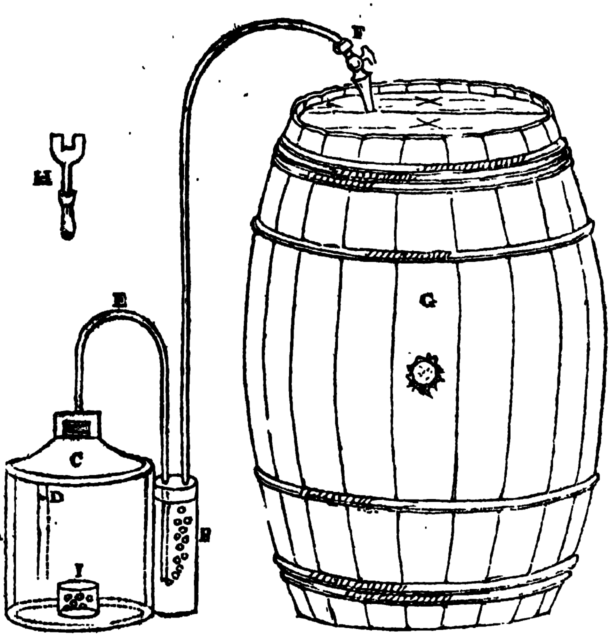
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 70.] SATURDAY, DECEMBER 25, 1824. [Price 3d.

"Dim as the borrow'd beams of moon and stars,
To lonely, wandering, weary travellers,
Is Reason to the soul. And as on high
Those rolling fires discover but the sky,
Not light us here; so Reason's glimmering ray
Was sent, not to assure our doubtful way,
But guide us upward to a better day." *Dryden.*

APPARATUS FOR RECOVERING FERMENTED LIQUORS WHEN SOURED



SIR,—I send you a drawing, together with a description explanatory of a little instrument, which I last summer found of considerable utility in a domestic point of view, and which may be equally so to that part of your readers who either brew themselves, or have occasion to keep in tap malt or other fermented liquors. It is a well-known fact, although not always the more agreeable on that account, that cyder, perry, and even ale and porter, leaving out of the question that undefinable compound, London small or table beer, very soon become, if in cask and in tap, extremely flat and insipid; this state continuing until another change takes place, viz. the production of acidity, or transformation, partially or wholly, into vinegar.

To remedy this evil mechanical means have been resorted to, and patent cocks and vent-pegs intro-

duced without number. These, however, only guard against the carelessness of servants, and are otherwise quite incompetent to the task, inasmuch as some body, either fluid or aëriform, must be admitted above to allow of the liquor escaping from the cock below. When, however, the fluid has become hard, or, in another word, sour, chemical means are called in; and if they cannot bring back the spirituous out of the acetous stage, they can at any rate prevent the injurious action consequent upon the internal reception of a fluid in such a state. To this effect, a few grains of the finely powdered bicarbonate of soda are generally added to a tumbler full of the beer; but should any liquor thus carbonated be left for a moment, it is worse in flavour than before; and as the degree of acidity varies every day, so, consequently, an increased dose of the soda is necessary, and to hit the point of saturation exactly is one of no small difficulty.

It is unnecessary to occupy your pages with the many objections to which this process is liable; those who use it would, I make no doubt, rather be without it if the beer could be saved. To this effect I made the present machine, which in every respect fully answered my expectations. It is simply a generator of carbonic acid gas, a body well known for its quality of resisting putrefaction for a considerable length of time, and which, if absorbed by any liquid, renders it brisker and more palatable than before.

Description.

A is a cylindrical stoneware vessel, capable of holding from three quarts to one gallon, or more if necessary; the size of the instrument varying, of course, with that of the cask in tap, and perfectly open at the top, with the exception of a rim, in which two notches are cut; attached on the one side is a small reservoir, B, for containing a little water, and which may be thought necessary to purify the gas as it is generated; this vessel, which need not be of a greater capacity than a half-pint measure, has no direct communication with the other part of this apparatus. C is another vessel, of a bell shape, quite open at the bottom, and furnished with a dome top, mounted with cap and screw, to which the pipe, E, is affixed. D is one of two small projections, which serve to keep the bell down and steady it in its place. F is an union joint, which connects the long pipe to the screw, which is first made fast in the vent-hole of the cask, by turning with the key, H. I is a bason or vessel perforated at the bottom, and which is used to hold the marble or chalk for generating the gas. To set this apparatus at work, first make the screw tight into the cask, G, which may either rest on its side, or be placed on one end, as in the drawing; the latter I consider preferable; the capillary attraction between the fluid and the fibres of the wood not being in this way impeded, and a small quantity of water poured on the top or head of the cask being sufficient to keep all tight. Secondly, remove the bell from the outer case, and put such a quantity of common marble, carbonate of lime, broken into fragments, about the size of a walnut, into the dish, I, as will two-thirds fill it; put the bell in its proper position, as represented; make the flexible tubing, L, fast; half fill the reservoir, B, with water, by one of the three apertures or necks with which it is furnished; take care to fit the cork in again quite tight, and connect the long pipe by means of the union joint to the screw, F; having done so, which will occupy but a very few minutes, pour on the top of the bell, C, a quantity of dilute muriatic or sulphuric acid, and which may be composed of one part acid to eight of water, until the liquor just makes its appearance at the top of the outer vessel; take out the cork in the reservoir, B, for two or three minutes, to suffer the common air contained in the bell to escape; fasten it again quite tight, and the process is finished. It will now appear evident to any one, that as soon as a certain quantity of carbonic acid gas is generated in the bell by the action of the acid on the marble, the acid liquor will be driven by the pressure inside into the outer vessel, a sufficient space for which has been allowed between the two; there it will remain until the stop-cock at F, to which the thumb and finger are applied, instead of the common vent-peg, is turned, when a quantity of fixed air will rush into the cock to supply the place of the liquor withdrawn. Should this stop-cock be left turned on, an absorption of a portion of the gas will be the only consequence; and this, as before stated, will only tend to increase the briskness of the liquor, although, in general, it will be better to turn it off. The diluted acid having now got to its level, supposing a quantity of beer, or whatever it may be, to have been withdrawn, equal to the size of half the bell, it is actively at work on the marble within, and would thus continue until the whole of this substance, or the acid, were expended, or, as will here be the

case, until the pressure produced again forces it between the two vessels. When this gas is used, another portion is made, and so on, until either the cask is emptied of its contents, or the acid neutralized Should the latter be the case, the addition of a little more strong acid will produce an extrication of a fresh portion of the gas, provided there still remains some undecomposed carbonate of lime; but if this is not the case, the bell must be raised out of the larger vessel, and the basin, I, replenished as before.

As I now fear that I have obtruded too much upon your time and space, I shall only add, that the expense of the gas, as generated by this machine, will not, for a butt, be more than equal to half a gallon of the same liquid of ale, and that it will preserve the whole to any moderate length of time from the injury which must always attend the admission of common air; and that even the expense of the machine itself will not be proportionate to the loss occasioned in the common way.

I shall take the opportunity, in a future Number, of giving a practical hint or two on a ready method of preventing liquors and home-made wines, especially while in a state of fermentation, from passing so suddenly into the acetous stage, and to which, in warm weather, they are so very liable. Until then,

I remain, Sir,
Your obedient servant,
F. Joyce.

11, Old Compton-street, Soho.

RAILWAYS.*

There is no single circumstance so essential to the improvement of a country, as abundant and easy means of internal communication. Part of the price of commodities always consists of the expense of bringing them from the place where they are made or raised to the market. In improved districts this amounts, in general, only to a small per-centage upon the first cost; but in rude and backward districts, unprovided with tolerable roads, it often enhances the cost of the article to three or four, or even ten times the original amount, and of course either greatly lessens or entirely precludes their use. Coal, for instance, is not found within less than a hundred miles of London; and had some more economical mode of conveyance than carting not been found out, this article, which is sold at 40s. a ton in the metropolis, would have cost six pounds—a price which would have been nearly equivalent to a prohibition against the use of this species of fuel. Such are the vast facilities which navigation affords for the transportation of commodities, that the coal of Gloucestershire can be sent by sea at a cheaper rate to Jamaica, than it could be sent by land in carts to London.

In early times the roads were mere foot-tracks, and goods were universally carried on the backs of horses To these succeeded gravelled roads for wheeled carriages, and the latter were followed by canals. A horse put into a wheeled carriage will draw, upon a well-made road, as much as four horses would carry on their backs; but when employed in tracking a boat on a canal, he will perform as much work as thirty horses in carts, or as a hundred and twenty pack-horses

Railways are a much more recent invention than canals; and for particular purposes, such as the conveyance of coal, stone, or other heavy commodities, down a short inclined plane, sloping at an angle of three or four degrees, they are decidedly superior As a means of general communication, they are cheaper in the first outlay than canals, more commodious in some respects, and adapted to a greater variety of situations; but so long as horse-power was the only power employed, it may be doubted whether the balance of advantage was not in favour of canals. We are quite satisfied, however, that the introduction of the locomotive steam power has given a decided superiority to railways. Indeed we are convinced, and we hope, by-and-bye, to convey some share of the conviction to the minds of our readers, that the general use of railways and steam-carriages, for all kinds of internal communication, opens up prospects of almost boundless *improvement, and is destined, perhaps,* to work a greater change on the state of civil society, than even the grand discovery of navigation.

The value of the railway, as a medium of commercial communication, has not escaped the sagacity of Dr Young. In his Lectures on Natural Philosophy he says:—"It is possible that roads paved with iron may hereafter be employed for the purpose of expeditious travelling, *since there is scarcely any resistance to be overcome except that of the air; and such roads will allow the velocity to be increased almost without limit.*"

Iron railways are of two descriptions. The *flat rail* or *tram* road consists of cast iron plates, about three feet long, four

* From "The Scotsman."

inches broad, and half an inch or an inch thick, with a flaunch, or turned-up edge on the inside, to guide the wheels of the carriage. These plates rest at each end on stone sleepers, of three or four hundred weight, sunk into the earth, and they are joined into each other, so as to form a continuous horizontal pathway. They are of course double, and the distance between the opposite rails is from three to four feet and a half, according to the breadth of the car or waggon to be employed. The *edge rail*, which is found to be superior to the tram rail, is made either of wrought or cast iron. If the latter is used, the rails are about three feet long, three or four inches broad, and from one to two inches thick, and they are joined at their ends by cast metal sockets attached to the sleepers. The upper edge of the rail is generally made with a convex surface, to which the wheel of the car is adapted by a groove made somewhat wider. When wrought iron is used (which is found to be equally cheap with cast metal, and greatly preferable in many respects), the bars are made of a smaller size, of a wedge shape, and twelve or eighteen feet long, but they are supported by sleepers at the distance of every three feet. The waggons generally used run upon four wheels, of from two to three feet diameter, and carry from 20 to 50 cwt. Four or five of them are drawn by one horse. On the dead level railway, constructed by Mr. John Grieve for Sir John Hope, near Musselburgh, which is one of the most perfect in Britain, a single horse draws five loaded waggons, each containing 30 cwt. of coals, at the rate of four miles an hour—in all seven tons and a half, exclusive of the waggons, which weigh three tons more. Reducing the velocity to two miles an hour, by Professor Leslie's rule, the horse should draw 12 tons, or 15 including the waggons. Mr. Stevenson observes, that "an ordinary horse, upon a well-constructed railway, on a level line of draught, will work with about *ten tons* of goods. Mr. Palmer, an English engineer, gives the following as the effect of a single horse's draught upon different railways, at two miles and a half an hour:

	Weight of the load drawn in pounds.	Weight of the load and waggon in pounds.
Lanelly tram road	4,602	8,850
Surrey ditto	6,750	9,000
Penryn edge rail	10,084	13,050
Cheltenham tram road	8,679	15,500
New branch of ditto, dusty	11,765	18,300
Ditto clean	14,079	21,900
Edge railways, near Newcastle	17,773	25,500

This Table shows the great superiority of the edge rail. The engineer observes too, that the vehicles were made in a very rude manner, and that were more care employed in their constructioa, the load might be much increased.

Railways are generally made double, one for going, and the other for returning. The breadth of ground required for a single railway is from nine to twelve feet; for a double one, from nineteen to twenty-five. The expense of a double road, including the price of the ground, may be estimated generally at from 3000*l.* to 5000*l.* per mile, or from *one-half* to *one-third* of the expense of a canal. Mr. Stevenson says—"The first expense of a canal will be found to be double, if not treble, the expense of a railway: such are the difficulties of passing through a well-cultivated country, and especially of procuring a sufficient supply of water in manufacturing districts, that four times the expense will in most cases be nearer the mark." (Memorial, p. 12.) We speak here of railways of the ordinary kind for the transportation of goods; but it is probable, that one destined to serve the purpose of a great national thoroughfare, for vehicles of all kinds, quick and slow, would cost at least twice as much. Even in this case, however, the original outlay would certainly not amount to more than a half or a third of what would be required for a canal of such a magnitude as to afford the same amount of commercial accommodation. The Union Canal has cost altogether about 12,000*l.* per mile; the Forth and Clyde, if executed at this day, would cost twice as much; the Caledonian Canal, if we exclude the locks, and reckon only what has been cut, will ultimately cost about 50,000*l.* per mile. Even deducting what has been expended on the locks, and on the harbours at its extremities, the expense will be nearly 40,000*l.* per mile.

A railway from Glasgow to Berwick, 125 miles long, projected in 1810, was surveyed by Mr. Telford, and estimated to cost 365,700*l.*, or 2926*l.* per mile. The estimated expense of a railway from Birmingham to Liverpool, distance 104 miles, surveyed within these few months, is 350,000*l.*, or 3365*l.* per mile. That of one from the Crawford Canal to the Peak Forest Canal, in Derbyshire, 32 miles long, is 150,000*l.*, or 4700*l.* per mile. A recent Carlisle Paper states, that the expense of a railway between that city and Newcastle was estimated at 252,000*l.*,

or 4000*l.* per mile; and that of a canal at 888,000*l.*, or 14,000*l.* per mile. A railway projected to run from Manchester to Liverpool, 33 miles, has been estimated to cost 400,000*l.*, which is no less than 13,000*l.* per mile; but this includes a large amount for warehouses and locomotive engines. Lastly, a railway from Dalkeith to Edinburgh, including a branch to Fisherrow Harbour, nine miles and a quarter long altogether, will cost, according to the recent estimate of Mr. John Grieve, 36,862*l.*, or 3983*l.* per mile, including the expense of five locomotive and one stationary steam engine.

Mr. Palmer, the engineer already mentioned, has proposed a new and ingenious species of railway, which deserves notice. It consists of a *single rail*, or continuous rod, of the usual form, but raised about three feet from the surface of the ground, and supported by cast metal pillars every ten feet. Two wheels with grooved edges, and 24 or 30 inches diameter, run, the one before the other, upon this railway; and from the iron frame to which they are attached by their axles, two chests or receptacles made of iron are suspended by stiff rods, exactly like panniers from the back of a horse. The chests hang very near to the surface of the ground; the load which is in those chests being so low, that the centre of gravity is always beneath the level of the rail, the machine, unless very unequally loaded, has no tendency to overset. The principal advantages of this contrivance are the following:—A moderate fall of snow would produce no obstruction; it could be carried over uneven ground, and over small hollows or ravines, without cutting, embanking, or casting bridges, by merely lengthening or shortening the pillars; the lateral friction, from the want of perfect parallelism in the two opposite rails of the ordinary railway, is avoided; and in many cases the rail might even be carried along the side of a common cart-road, with a very small additional expense. Mr. Palmer, who made some trials with a portion of railway formed in this manner, states, that the effect produced by the draught of a single horse was nearly double of that produced on the common railway, or 45,000 pounds, including the vehicle. There is nothing in the nature of this machine to render steam power inapplicable to it.

(To be continued.)

ELEMENTS OF AERIAL NAVIGATION.

It is a singular circumstance in the history of the arts, that an invention at its first appearance is frequently pursued with the greatest eagerness, and yet will afterwards be wholly neglected for years, until some happy improvement fixes it permanently on the public attention. Many will remember the great zeal excited by the subject of aerial navigation among scientific men, and the astonishing subsequent neglect of an art so important, until the late revival of the subject by Sir George Cayley and other eminent philosophers.

The following statement of every thing important which has been suggested on this point, with some new views, is offered for the purpose of facilitating further inquiries.

Vertical Motion.

1. The balloon being inflated with gas, descends by letting out a portion of it, and ascends again by throwing out ballast. To this method it is a radical objection, that the means of alternate ascent and descent are very soon exhausted.

2. The air in the balloon being expanded by heat, the vertical motion is produced by increasing or diminishing the quantity of fuel. To this method it is an objection, that the fuel will ultimately be exhausted; also, if common air be used, the balloon must be of very large dimensions to support the car; and if the air be any of the lighter gases, the expansion by heat is attended with the greatest danger.

3. The balloon being inflated with gas, another is suspended below the car, and into this the circumjacent air is forced by an easy mechanical contrivance, and is let out again at pleasure. By these means the machine descends upon increasing the density of the air, and ascends upon restoring it to its former state. This method is worthy of peculiar consideration, not being liable to the former objections, and being analogous to that contrivance of Nature, by which fishes sink at pleasure, and rise again to the surface.

Lateral Motion.

1. The most obvious method of producing a lateral motion is by taking advantage of the winds. These are—occasional winds; trade winds between the tropics; the land and sea breezes, which, in warm climates,

set from and towards the shore by day and night alternately; the superior currents of air, which often proceed in a direction contrary to those below; and the breezes, which commonly follow the direction of every river. To these aids we may also add the remarkable phenomenon observed by all aerial navigators, viz. that the balloon sinks lower than usual when over water, and that it has a tendency to keep the direction of a river. This circumstance may partly be attributed to the wind following the current, but principally to the specific gravity of air impregnated with aqueous vapour being diminished, and the tendency of the machine to the point of least gravity.

2. The very ingenious proposal lately made, of directing a balloon, like the tacking of a ship, by means of an inclined plane, is worthy of much consideration. It is obvious that the additional weight of an inclined plane may be avoided, by forming the balloon of some figure not a sphere; thus, for instance, it may be an oblong spheroid, whose major axis is kept inclined at an angle of 45 degrees to the horizon, by means of the weight suspended in the car. But a little calculation will show that the lateral motion produced must be very small, and not sufficient to counteract any considerable wind; for the whole vertical velocity in the ascent is easily computed, and is not large; and the resolved motion in a lateral direction, being a function of the angle of inclination, is still smaller, and much less than the velocity of any gale of wind.

3. A great number of mechanical contrivances in imitation of wings and oars have been suggested, and even tried, but with a most discouraging degree of success. Upon examining the cause of these failures, it is easy to see that the experiments have been made on principles fundamentally erroneous. In the first place, the power has always been applied to the car, though it is obvious that in such a case the greatest part of the power is lost in giving the car a rotatory motion round the balloon, and that the power, in order to be entirely effective, should be applied in a line passing through *the centre of pressure of the whole system.* In the second place, the mechanism imitated has been that employed by Nature in enabling a bird to fly, though it is obvious that the animal's wings are contrived as much for *support* in the air, as for lateral motion. Our whole attention should be directed to the mechanism of fishes, whose air-bladders assimilate them to an inflated balloon, and in which the system is wholly contrived for the purposes of horizontal motion, progression being produced by the rapid vibrations of the tail, acting like a single oar upon the hinder part of a boat. When we see the rapid progress made by the salmon against the swiftest stream, we should not despair of success; and certainly not on account of the small muscular power of man, if we consider that the steam-engine, with the weight of one man, commands the power of four. It is indeed a matter of serious inquiry, whether such a machine would not require something more solid to work upon than a metallic poop, or any thing which the balloon could support. It is obvious that much advantage will be gained, if any mechanism acting on the air should move with much greater velocity than the balloon, as the resistance or power increases with the square of the velocity. It will also be a matter of experiment what form of balloon is least resisted; for the received systems on this subject are universally allowed to be erroneous, as the resistance varies as $ar^2 \pm br$ (b being negative in an elastic medium), and as it will probably be found to be a function of the figure of the body resisted.

SAFETY COFFIN CASE FOR THE DEAD

SIR,—Notwithstanding it is necessary for the benefit of mankind, that subjects for dissection should be obtained by that part of the rising generation into whose hands the lives of people are to be entrusted, there cannot possibly be a more unhappy state

of mind than that which is excited by the rapacious pillage of the last remains of a dear friend or lamented relative. There is something, besides, so repugnant to the natural feelings of civilized man in the profession of *sepulchral pillager*, that surely no punishment can be considered too bad for the brute who is so abject as to follow the abominable calling, which, while it renders him fit for every species of crime, for the sake of the sacrilegious bribe it procures, is the means of turning the afflicting but wise dispensations of Providence into the most heart-rending anguish, for which time itself has scarcely any alleviation. To prevent, in some degree, this additional misery to the day of mourning, put a bar to the disgraceful traffic, and excite legislative influence to meet the necessity of providing means of anatomical supply, are the inducements which have caused me to trouble you with the following suggestion.

Iron coffins are certainly inestimable in the protection they afford against the robbery of graves, but they are both expensive and inconvenient; few can purchase them, and their duration must, in time, be productive of serious inconvenience in our churchyards, limited as they are, and more limited as is the burial-ground of a single family. I would suggest a *Coffin Case*, made of iron, formed of top, sides, and ends, but no bottom, so as to admit of being placed over the *last coffin, continually*, which is put into the grave. *One* would answer for the protection of all beneath, and, being sufficiently capacious, no inconvenience in point of size could happen. Durability would then be a desirable object, and the expense to a family considerably lessened, while clerical privileges would be retained as heretofore, and, of consequence, clerical altercation prevented. Many contrivances might be resorted to in order to impede the lifting of the *coffin case*, such as having plates from the lower edge of the sides projecting in a horizontal direction, or a couple of iron bars on each side fixed, or passing through staples connected with the outside of the top. On this principle I conceive every family might be in possession of one of such cases that, on the present system of iron coffins, could not meet the expense.

I am, Sir, yours, &c.

T. H. P.

Chatham.

SAFETY FOR THE LIVING AND DEAD.

Sir,—It has ever been a matter of much surprise to me that any one, excepting he be a *professional* man, should be found to advocate the practice of robbing the graves of their dead. It is one of the most abominable crimes existing in this country—nothing can be more repulsive to the feelings of humanity and delicacy than the tearing open the sanctuary wherein is contained the sacred remains of a human body, and thus brutally disturbing the last resting-place of man. I would ask, with our immortal poet,

> "What guilt
> Can equal violations of the dead?
> The dead, how sacred! Sacred is the dust
> Of this heav'n-labour'd form, erect, divine!
> This heav'n-assum'd, majestic robe of earth!"

And none but the most hardened brutes, in human form, follow this horrible and revolting occupation. The dead, and in particular the repositories of the dead, have, in all ages, in all countries, by all religions, and at all times, been held as sacred. A churchyard is calculated to produce feelings of a solemn and interesting nature, and shall we, for the pleasure of a few, allow it to be profaned by polluted feet and still more polluted hands? But it is answered, in opposition to every objection and argument which can be urged against this vile traffic in human flesh, that it is necessary for the procuring of subjects for the medical students at our hospitals. And can no other plan be adopted than the present shameful custom which prevails? Cannot our schools of medicine, with all their collected wisdom, devise some method whereby they may be supplied? No, they will not, for

reasons too obvious to be mentioned; but I think the following will be a specific for all the evils which arise on the present disgusting system:—Let every man who feels such a zeal for the improvement of our schools in surgery, that his zeal will carry him so far as to allow him to encourage robbery, and that robbery of the worst kind—let him leave by will, to any hospital he chooses, his own body to be dissected. This, I think, is but fair; for, as they would not scruple to cut up any man's body they may get, however they may violate the tender feelings of nature, surely they can have no rational objection to a plan which will not only save a vast expense (for they make a great cry out about the price), but be greatly conducive to the cause they so strenuously advocate, and to support which they resort to such barbarous and unjustifiable means.

Thinking your Correspondent who accuses T. P. A. of not looking at the subject in all its bearings, has fallen into the very error he points out, I have been induced to take up my pen in order to put the subject in its true light

I am, Sir, &c.

T. M. B.

RUTHVEN'S ECCENTRIC WHEEL.

SIR,—In No. 63 of the Mechanics' Magazine you have inserted an article respecting my "method of procuring mechanical power," under the title of *Ruthven's Eccentric Wheel.*

It is not necessary to inquire the "why or the wherefore" you did not state, at the same time, that I have a patent for the invention, which you certainly had in your power to do; but I am afraid this omission has made your Correspondent, "W. K. Shenston," rather unintentionally commit himself, as I find in No. 66, which I only got to-day, that his desire to be considered the original, or at least the previous inventor, has induced him to come publicly forward and state, "that the same has been in action above two years in his manufactory." Of course he is not aware that he thus acknowledges the pirating of my patent *above two years*. He also states, "Mr. Ruthven is not, therefore, the first who has applied this power,"—he "has six pair thus employed." This is information which was certainly uncalled for. The motive for it I shall not question; but it undoubtedly too readily evinces a spirit of envy, and that, too, rather hastily, as I cannot conceive that your account of the invention, without any diagram, could have enabled him so promptly to assert that his was the same. My correspondence with him, however, will set that point at rest, and the *reason* why it is to be inferred, that "Mr. Ruthven is not, therefore, the first who has applied this power."

My motive for writing to you on this subject is chiefly to correct your omission, and prevent others from falling into a similar error with your Correspondent, Mr. Shenston.

As I am extremely partial to your Mechanics' Magazine, and one of its numerous well-wishers, I intend troubling you with some applications of the above power, with a sketch, to enable your readers to have some idea of it.

I am, Sir, yours, &c.

JOHN RUTHVEN.

New-street, Edinburgh,
Dec. 11, 1824.

[We really were not aware that Mr. R. had taken out a patent. We shall be glad to give a place to the communications which he promises.—ED.]

BOOKBINDING.

SIR,—If your Correspondent W. B. jun. at p. 201, vol. II thinks he has made a discovery or improvement in the lettering of books, when he says that such words as "ledger," "journal," &c. might be cut in one piece of brass, and worked off at once, I can only say that such has been long the practice already. I have some by me, cut more than twenty years since, on that principle, such as "Charles XII." "Peter the Great," "Johnson's Dictionary," &c. &c. Indeed, such tools are to be found in almost every binder's shop.

I am, Sir, yours, &c.

A BOOKBINDER.

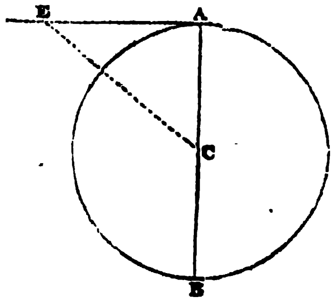
Bartholomew Close.

MECHANICAL GEOMETRY.—No. IV.

(Continued from Page 195.)

THEOREM V.

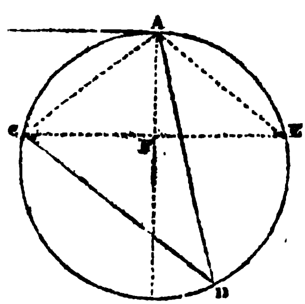
If, from the extremity of any diameter of a circle, we draw a line perpendicular to it, it will be a tangent to the circle in the point the diameter meets it.



If, from the extremity A of the diameter AB, we draw AD perpendicular to AB, it will be a tangent to the circle, or touch it in the point A without cutting it, according to Definition 10, Part II.

From the centre, C, draw any other line, as CE, to meet AD; now the triangle AEC has, by its construction, the angle at A a right angle, or 90 degrees; the angles at C and E will be each less than a right one; now, as the angle at A is the greatest angle, the side EC is always longer than AE or AC (by the Corollary to Theorem VI. Part I.); hence, however near we make the point E to A, EC will always be greater than AC, which is the radius of the circle, and hence the point E will always be without the circle, and cannot coincide with it but in the point A; therefore the line DEA is a tangent to the circle, and only meets it in one point at A, but does not cut it.

B.



THEOREM VI.

The angle formed by a tangent and a chord drawn from the same point in a circle, is equal to the angle at the circumference of the opposite segment, that is, it is equal to the angle formed by two chords drawn from the extremities of this chord,

to meet in the circle on the opposite side to the angle formed by the chord and tangent.

Let AB be a tangent to the point A, and AC any chord drawn from the same point; now, if we draw any two chords, as AD and CD, from A and C to meet in D, the angle BAC will be always equal to the angle ADC.

Having drawn the figure, as in the preceding page, cut out the triangle ADC, and apply the angle D to the point A, and let the line AD correspond to the tangent AB, then you will find that the side DC will coincide with the chord AC; consequently the angle BAC is equal to the angle ADC.

Or, more geometrically, draw CE parallel to AB, then (by Theorem III. Part I.) the angle BAC equals the angle ACE; now join AE, and draw AF perpendicular to AB or CE, then (by Theo. IV. Part II.) CF is equal to FE, and hence the two triangles AFC and AFE are *identical*, that is, the side CF equals FE, and the side AF common to both triangles, and the angles AFC and AFE both right angles; hence the angles ACF and AEF are equal, but ACF is equal to BAC; consequently AEC, or its equal, ADC (by Theorem I. Part II.) will also be equal to the angle BAC: which was to be shown.

Corollary 1.—Hence the angle any chord and tangent make with each other is equal to half the arc that chord subtends, that is, the angle BAC is equal to half the number of degrees the arc AC measures, for the angle CDA is equal to half the angle at the centre of the circle (by Theorem II. Part II.), which is the measure of the arc AC.

G. A. S.

(*To be continued.*)

INQUIRIES.

NO. 86.—HIGH AND LOW PRESSURE ENGINES.

Sir,—I should be glad if some of your intelligent Correspondents would inform me, through the medium of your valuable Magazine, the space an Engine constructed on the High Pressure principle, with all its apparatus, of 120-horse power, worked by a pressure of 120 pounds on the square inch, would occupy in a vessel 140 feet in length between the perpendiculars, 27 feet in breadth, and 17 feet in depth; consumption of coal per hour; and whether or not it would answer the purpose equally well as one constructed on the Low Pressure principle, occupying a space of 50 feet in the length, all the breadth, and all the depth, worked by a pressure of four pounds to the square inch. If the comparative weight of the two engines, boilers, &c. is added, the obligation will be still greater.

B. W.

Blackwall.

NO. 87.—BORING FOR WATER.

Sir,—Your valuable work, the Mechanics' Magazine, having been lately put into my hands, and observing, in No. 19, some excellent remarks on Boring for Water, the usefulness and benefit of which is generally acknowledged, but at present little understood (at least in this part of the country), I shall feel much indebted to any of your numerous Correspondents for a particular description of the best means in use for boring for water, and the implements suited for the different strata; and whether a windlass or an engine should be used in propelling the iron rods and implements. In situations where the water cannot be raised to the surface by boring, but may be found at some distance underneath, what would be the best and least expensive mode of adopting? Is it necessary to sink a well as far as the spring, or to any given depth? and what is the cheapest sort of pumps suited for such purpose?

My object in this inquiry, though I profess to be at present little acquainted with the details of the subject, is with a view to practice; any hints, therefore, that may promote the system of boring in this part of the country, will be gratefully acknowledged by, Sir,

Your well-wisher,

Exeter. H. L.

IRON-MAKING.

Mr. Mushett, one of the most scientific and ingenious of our iron masters, has, in some late inquiries into the history of the discovery and use of cast iron, appeared disposed to fix its date in England about the year 1550; before which time it appears that the art of casting iron was unknown, and he supposes it to have been an English invention.

There were in England and Wales, in the year 1720, he says, fifty-three blast-furnaces employed in making 17,350 tons yearly, or a little more than five tons of pig-iron each weekly. At that period fourteen of these furnaces existed in the two south-eastern counties of England, Kent and Sussex, where now one, at most, survives, near Battle.

Mr. Mushett suggests, as a curious matter of antiquarian research in Sussex and Gloucestershire (including the Forest of Dean), and several other counties, to ascertain the date and place of erection of the first tall blast-furnace in England for the making of cast or pig iron. At present the size and numbers of these furnaces are so wonderfully increased in Britain as to manufacture nearly *half a million tons* of pig-iron annually,* with a consumption of pit-coal, in all the attendant manipulations, equal, at least, to *five million tons* annually. T. M. B.

ART OF WEAVING."

When briefly noticing Mr. Murphy's excellent work on this subject in our last, we made a promise, which we now proceed to fulfil, of giving a more detailed account of it, and supporting our opinion by a few extracts.

A short Preface is occupied in giving an account of the origin of the Art of Weaving, and its introduction and progress in this country.

"With respect," says Mr. M. "to the processes or manipulations of weaving as conducted by the ancients, nothing satisfactory can be gathered from history, although it is highly probable that they were either the same, or similar to those at present practised by the natives of India. One thing, however, is certain from their fables and sculptures, that the Egyptians, Greeks, and Romans, spun their yarns with the distaff and spindle; and it has been remarked, that these simple implements have been used for spinning in all the countries which have been discovered by navigators for the last three centuries. They are still employed by the natives in the East Indies, and they were common in Scotland in the middle of the last century.

"That the art of weaving was unknown in Britain before the Roman invasion, at least for the purposes of clothing, will appear from the following curious picture of its inhabitants at that period, drawn by the great poet Milton. 'At Cæsar's coming hither,' says he, 'such likeliest were the Britains, as the writers of those times and their actions represent them, in courage and warlike readiness, to take advantage by ambush or sudden onset, not inferior to the Romans, nor Casibelan to Cæsar; in weapons, arms, and skill of encamping, embattling, fortifying, overmatched; their weapons were a short spear and light target, a sword also by the side; their fight sometimes in chariots, fanged at the axle with iron scythes, their bodies most part naked, only painted with woad in sundry figures, to seem terrible, as they thought; but if pinched by enemies, not nice of their painting, to run into bogs up to their necks, and there stay many days, holding a certain morsel in their mouths no bigger than a bean, to suffice hunger. Their towns and strongholds were spaces of ground fenced about with a ditch, and green trees felled overthwart each other; their buildings within were thatched houses for themselves and their cattle. In peace, the upland inhabitants, besides hunting, tended their flocks and herds, but with little skill of country affairs; the making of cheese they commonly knew not; wool and flax they spun not; gardnery and planting, many of them knew not; clothing they had none but what the skins of beasts afforded them, and that not always; yet gallantry they had, painting their own skins with several portraitures of beast, bird, or flower.'

"After the Romans had obtained a footing in Britain, they established a woollen manufactory at Winchester for clothing their army, and also taught the natives the art of weaving and the culture of flax. The Saxons afterwards introduced the manufacture of several kinds of cloth, chiefly for domestic purposes; among which is said to be the weaving of counterpanes.'

"Little farther is known of weaving in

* We suspect this calculation has not been recently made. The amount of the manufacture for the present year is certainly much greater.—Edit.

Britain till early in the fourteenth century, when Jack of Newbury introduced the manufacture of broad woollen cloth, which was afterwards protected and encouraged by King Edward III, and which has ever since been the staple of England. The following extracts, however, from Anderson's Progress of the Arts and Sciences, and others, will exhibit the state of the cloth manufacture in Europe from this period till the end of the seventeenth century, when a new era may be said to have commenced in the history of the arts in Britain :—

ANNO

1209 Venice gains the silk manufacture from Greece.

1248 A company of wool merchants settle in London.

1253 Some fine linen made in England.

The latter end of this century the better sort of people wore woollen shirts; the most considerable citizens gave not above one hundred livres for a daughter's portion. But now, says Laffiamma, we wear linen. The women wear silk gowns, some of which are embroidered with gold and silver.

Table linen was scarce in England.

1305 The city of Louvain in Flanders, with the adjacent villages, were said to contain above an hundred and fifty thousand journeymen weavers.

1327 The first broad cloth made in England by Jack of Newbury.

1331 King Edward III. resolves to promote a woollen manufactory in England, and to this end brings seventy families of Walloons into England.

1336 Two Brabant weavers settle at York with the king's protection; as it may prove, said the king, of great benefit to us and our subjects.

1337 Laws enacted for encouraging the woollen manufacture in England.

Holland gains part of said manufacture from Flanders and Brabant.

1339 Looms set up in Bristol for woollen cloth.

1348 Norwich eminent in the worsted manufacture.

French fashions introduced into England.

1351 Foreign weavers numerous in London.

1376 Woollen cloth made in Ireland.

1380 The city of Louvain loses its manufacture, by an insurrection of the journeymen weavers.

1386 A company of linen weavers established in London.

1390 Coarse cloth made at Kendal.

1398 Foreign woollen cloth first prohibited in England.

1436 Coventry eminent for the woollen and cap manufacture.

1455 Some silk manufacture carried on by women in England.

1488 Woollen cloth not to be exported until fully dressed.

1519 Spain loses her woollen manufacture, which she has not been able to regain to this day.

1521 France first gains a silk manufacture.

1533 Hemp and flax ordered by statute to be sown in England.

1537 Halifax in Yorkshire commences the woollen manufacture.

1549 King Edward VI. encourages foreign Protestants to settle in England, viz. Walloons, Germans, French, Italians, Polanders, and Switzers, who much advance manufactures and trade

1567-8 Persecutions of the Protestants in France and the Netherlands, under the Duke of Alva, drive many of them into England, where they establish a variety of manufactures.

1582 Value of woollen cloth exported from England, 200,000l. annually.

1590 Manufacture of sail-cloth first introduced into England.

1597 Logwood, by law, forbid to be used in dyeing, but afterwards found to be of great use.

1608 Silk worms brought into England.

1614 Dyeing cloth in the wool first invented.

1619 Tapestry work first introduced into England.

1620 Broad silk first manufactured.

1622 The woollen manufacture in a declining state.

1624 The Dutch make woollen cloth to the amount of 25,000l. a-year.

1641 Ireland spins linen yarn for Manchester, who returns it to them made into cloth.

1643 Bow dye or scarlet first made.

1646 The French begin their manufacture of fine woollen cloth, under the patronage of Cardinal Mazarine, at Sedan.

1650 The worsted manufacturers of Norwich incorporated.

1654 The fine broad cloth of England sent to Holland to be dyed.

1663 Forty thousand men, women, and children, employed in silk-throwing in and near London.

1666 Burying in woollen established by law.

1667 Dyeing and dressing woollen cloth perfected in England by one Brewer from the Netherlands.

ANNO

1668 The Scots send linen yarn to England.

1670 The wear of muslins first introduced.

The linen manufacture began to be encouraged in Ireland, where it is very considerable.

1685 Seventy thousand refugees came from France on the revocation of the edict of Nantz (by which edict the Protestants there enjoyed the public and free exercise of their religion), and settle in Great Britain and Ireland, bringing with them the blessings of industry, and an extensive knowledge in many manufactures yet unknown there; of these two thousand are supposed to have gone to Ireland. The whole number who, for conscience sake, quitted their native country, are said to have been 800,000; they distributed themselves in Holland and Brandenburgh, where they erected the fabrics of cloth, serges, stuffs, druggets, cranes, stockings, hats, and all sorts of dyeing; and among them were goldsmiths, jewellers, watchmakers, and carvers. Many settled in Spitalfields, London, where they erected the manufacture of silk, and helped to people the suburbs of Soho and St Giles By them was introduced the art of making crystal, which was entirely lost to France.

1696 A law to prevent the exportation of English wool, and the importation of Irish. Hemp, flax, linen, thread, and yarn from Ireland, admitted duty free. (This law gave rise to the now happy state of the linen manufacture in Ireland.)

"From these extracts it will appear, that Britain and Ireland were first indebted to the bigotry and persecuting spirit of the continental powers of Europe, in the sixteenth and seventeenth centuries, for many of the useful arts which they now enjoy, and which laid the foundation of some of our most extensive manufactures.

"The cloth manufacture made little progress in Scotland till after the Union, when it was greatly promoted by the fostering care of the Board of Trustees, which was established by charter at Edinburgh, in the year 1727, for protecting and encouraging the Scotch manufactures and fisheries. The greater part of the goods manufactured in Scotland, however, were made of linen yarn, till about the year 1759, when a branch of the silk trade from Spitalfields, London, was established at Paisley, where it was brought to such perfection, especially in the more light and fanciful kinds, that in a short time Paisley silks not only rivalled those of the south, but had a preference in all the markets in Europe; and this laid the foundation for that extensive knowledge of fancy weaving, for which the tradesmen of Paisley have since become so famous, and which has now spread over the west of Scotland.

"About the same period, the increasing demand for cotton goods induced several individuals to attempt a more ample supply of yarn, to meet an extension of this branch of manufacture; but all without success till the year 1767, when Richard Hargreaves, a weaver in Lancashire, invented the cotton jenny, which, though at first it contained only eight spindles, was afterwards enlarged, so as to contain 20, 30, and even 80. And about two years after this invention, Sir Richard Arkwright improved the spinning of cotton still farther, by the application of water for the moving power, &c. together with the addition of rollers, and other modifications of the machinery. The extension of this rising manufacture now became so rapid, that it would soon have felt a serious check, had not the discoveries in chemistry, which were made about the same time, come in to its aid, particularly in the processes of dyeing and bleaching; by the latter of which, the manufacturer was enabled, instead of a process of some months, to bring his goods to the market in the course of as many hours after they came from the loom. These inventions and discoveries, together with the improvements in calico-printing, the discharging of colours, particularly of Turkey red for Bandanas, the application of steam for the moving power, and innumerable other discoveries in mechanics and chemistry, which would fill a volume to give in detail, have contributed, within the last forty years, to raise the cotton manufacture to a state of perfection and extent unknown in the history of commerce."

In the body of the work, Mr. M. proceeds to explain the Art of Weaving as it exists now in Britain at the present day, in all its branches, and furnishes such a store of facts and details respecting them, as has never yet (to our knowledge) been before the public. The heads of the different chapters will suffice to show our readers the great value and originality of the information contained in them.

Chapter I. treats of the Construction of Loom Mountings, Draughts and Cordings, Substitutes for Treadles. Chapter II. of Tweeling, Regular Tweels, Satin Tweels, Fancy Tweels, Turned or Reversed Tweeling. Chapter III. of Lind Work. Chapter IV. of Dornick and Diaper. Chapter V. of Double Cloth. Chap-

ter VI. of the Manufacture of Corduroys, Velvets, Thicksets, &c. Chapter VII. of Crossed Warps, Gauzes, Nets, and Lappets. Chapter VIII. of Spotting, Common Spots, Paper Spots, Allover Spots, Brocades, Cut Stripes, and Seeding. Chapter IX. of Flushing, Dumb Seedings, Flushed Stripes, Checks, and Borders, Flushed Nets, and Dumb Flowers. Chapter X. of Compound Mountings, with their Draughts and Cordings Chapter XI. of the Draw Loom, Draw Loom Patterns, and Flower Lashing. And Chapter XII. contains Calculations and Tables connected with the Art of Weaving; such as for finding the Quantity of Weft on any number of Lashes, and at different Breadths; for shewing the Quantity of Cloth on any number of Lashes at 50 and 60 Shots in an inch, &c. &c.

As a specimen of the superior style in which the work is written, and as well adapted for quotation, we shall extract part of what the author says on the subject of Pattern Drawing.

"This is perhaps the most important, as well as the most delicate department in the whole course of fancy weaving; for it is on a judicious selection and extensive variety of patterns, combined with economy in the disposal of colours, that the success of the manufacture will ultimately depend. The manufacturer, therefore, though no designer himself, should possess a competent knowledge of drawing, or at least of hand sketching. This would not only improve his taste, but would enable him, when any new or striking objects occurred, to communicate his ideas with precision to the pattern drawer, and to make a more tasteful selection from the productions of others. This is, in general, the case in France; and the consequence is, that French patterns are usually distinguished for the ease and elegance of their style, while the greatest economy is observable in the use of the materials of which they are manufactured.

"On the other hand, the qualifications of a pattern drawer, who would excel in his profession, are by no means of a superficial nature. A facility in sketching or delineating any object that may present itself, whether natural, artificial, or imaginary, combined with a thorough knowledge of the principles of weaving, at least with those branches with which he is more immediately connected, are indispensable requisites. The pattern drawer, like the poet and the painter, ought to possess an unlimited fancy, and a strong and lively imagination; to be deeply impressed with the beauties and charms of Nature; and to be able to draw from thence the principal effect of his designs. A chaste taste also is as necessary in the pattern drawer as in the manufacturer; and this will be greatly heightened and improved by a little knowledge of geometry, particularly of symmetry and proportion; for nothing can be more offensive to a person of genuine taste, than a pattern or picture crowded with an incongruous assemblage of distorted objects.

"The first attempts of a learner in this art should therefore be to acquire a facility in sketching a variety of simple objects, such as straight lines, circles, ovals, and other curved figures. After he has made some progress in these exercises, he may proceed with copying from good sketches, particularly, at first, from the most simple specimens of that kind of patterns to which his attention is to be afterwards directed. It must, however, be observed, that when he has attained as much practice as enables him to sketch from his own fancy, he should be very cautious at first, both with respect to the objects which he selects for his designs, and the manner in which they are to be disposed; for on his taste and judgment in making these experiments will depend, in a considerable degree, his peculiar style afterwards. He will therefore derive much advantage, in the early stages of his progress, by procuring as great a variety of appropriate objects for his patterns as possible, such as leaves, flowers, fruits, shells, &c. which may be copied either from drawings or the originals; and from this fund he will afterwards, with a little modification of their forms, be able to give a considerable diversity to his designs; at the same time he ought to avoid, as much as possible, a certain sameness of style, which is sometimes found in the productions even of the best drawers.

"Harness patterns are, in general, first drawn on common paper, of the same size that they are to occupy on the cloth, which is ascertained by taking their dimensions from a reed scale, and these are denominated sketches. For patterns which are to be all white, the sketches may be finished with a black lead pencil, either shaded or not, as the pattern drawer may find occasion. In drawing sketches for allovers, or other kinds of running patterns, particular care must be taken, where the stalks or other members join, to avoid stiffness or unnatural turns, and to observe that none of the parts be too much crowded, nor improper vacancies left. At these joinings, the stalks, &c. may be continued beyond the limits of the sketch until they be completed, or until their curvatures or bendings be accurately ascertained, and then transferred by means of a bit of spare paper to the opposite side of the pattern.

"For coloured patterns, a rough sketch

is commonly drawn out on coarse paper, which, after all the necessary corrections are made, is traced on clean drawing paper, when it is ready for colouring. The method of tracing these sketches is as follows:—Prepare a sheet of wove writing-paper by rubbing it over on one side, first with sweet oil, and afterwards with ground verditure; when it is dry, lay it on the clean drawing paper, and over it the rough sketch. Then with a blunted steel point trace over all the outlines, and a very fine delineation of the pattern will be produced. This done, the different colours are laid on with camel's hair pencils, agreeably to the taste of the manufacturer, or to the style of work to which the patterns are to be applied. It is necessary to observe, however, that, as in many kinds of patterns, particularly those intended for low priced goods, the greatest economy is frequently necessary in introducing the colours, the pattern drawer's chief study should be to produce as much effect with as few colours as possible.

"Pattern drawers have also frequent occasion to copy extensive patterns from the cloth, such as coloured shawls, pine plaids, &c This is easily effected by laying a sheet of transparent paper over the pattern to be copied, through which every object and colour will be distinctly seen, and traced with a black lead pencil; it may be afterwards transferred to a sheet of clean drawing-paper, by means of a tracing paper and steel point, and coloured in the same manner as the original. For present use, a sheet of silk or tissue paper may be brushed over with sweet oil until it be all thoroughly wet, and when dry, it will be fit for use. But as this paper will soon turn dim by exposure to the air, the following recipe has been recommended in the Panorama of Arts.—'Take one quart of the best rectified spirits of turpentine, and put to it a quarter of an ounce of the sugar of lead finely powdered; shake it up, and let it stand a day and a night; then pour it off, and add to it one pound of the best Canada balsam; set it in a gentle sand heat, and keep stirring it till it is quite mixed, when it will be fit for brushing over the paper, which in about four days will be fit for use. The paper rendered transparent is that which stationers call bank post; but when great nicety is required, tissue paper, which is still thinner, will be proper. Before it is brushed over with the mixture, after having been made damp by laying it over another damp sheet of stronger paper, it should be pasted by the edges upon a frame, and suffered to dry.'

"The pigments used by pattern drawers and designers, are, in general, the same as those which are made up into cakes, and sold in the shops under the name of water colours. In water colour paintings, however, such as flowers, landscapes, &c. the pigments employed are chiefly the transparent kind, and the different shades are wrought up by repeated touches of the pencil, till they have acquired their full effect; but in the sketches for patterns, the colours must be all opaque, or of such a body as may be easily laid on the paper with only one touch of the pencil, and at the same time stand distinct, without allowing one to appear through or blend with another. Colours, therefore, which are naturally transparent, must be made opaque, by mixing with them a little flake or other fine white

"The colours used for designing, however, ought to be rather of a semi-transparent nature, that they may not only work freely and expeditiously with the pencil, but that the flower-lasher may be able to see the lines of the design-paper distinctly through them Some of the London designers have indeed carried this idea so far, as to have their design-paper transparent, and to paint the pattern on the back with opaque or body colours.

"In drawing sketches for most kinds of harness patterns, it is of considerable importance that the colours on the sketch be adapted, as nearly as possible, to the tints of the materials of which they are to be fabricated on the cloth. This would often prevent disappointment in the manufacturer, who, without considerable experience, is liable to be deceived by a brilliant display of colouring on the sketch, which cannot be realised in the loom; and this is more particularly the case in the cotton manufacture, which does not admit of such a beautiful variety of tints as either silk or worsted.

"Pattern drawers, therefore, generally prefer colours of their own preparation to those sold in cakes, not only on account of economy, but that they can more easily obtain those tints, and of that consistence, which this species of drawing requires. For these reasons, it may not be improper here to introduce a list, with some useful remarks, of those pigments which are most commonly employed in water colour painting, leaving to the artist the choice of those which may seem best suited to that branch of manufacture in which he is more immediately engaged.

"The principal colours used in water painting are yellow, orange, brown, red, purple, blue, green, black, and white; of the seven first of which there is a great variety of shades, besides their compounds."

The illustrative plates, engraved by Mr. Maclure, from drawings furnished by the author, contain nearly two hundred and fifty different figures, executed with great clearness and

accuracy, and serve to render the work altogether one of unrivalled utility to our cloth-manufacturers of every description.

BURSTING A HOGSHEAD.

It is justly affirmed by some writers on natural philosophy, that a certain quantity of water, however small, may be rendered capable of exerting a force equal to any assignable one, by increasing the height of the column and diminishing the base on which it presses. Dr. Goldsmith observes, that he has seen a strong hogshead split in this manner. A small but strong tube of tin, twenty feet high, was inserted in the bung-hole of the hogshead. Water was then poured into the tube till the hogshead was filled, and the water had reached within a foot of the top of the tin tube. By the pressure of this column of water, the hogshead burst with incredible force, and the water was scattered in every direction.

GOLD LEAF.

It requires three hundred thousand of such gold leaves as are commonly used in gilding to make an inch in thickness. The tenuity of Gold Leaf is so great that it is, in some measure, transparent. When it is interposed between the eye and external objects, they are distinctly perceived, of a greenish colour.

LARGE AND SMALL HORSES.

Animals draw by their weight, and not by the force of their muscles. The hind feet form the fulcrum of the lever, by which their weight acts against the load, and the power exerted, is always proportioned to the length of the lever, the weight remaining the same. Large animals, therefore, and other animals, draw more than small ones, even though they have less muscular force, and are unable to carry such a heavy burden. The force of the muscles tends only to make the horse carry continually forward his centre of gravity, or, in other words, the weight of the animal produces the draught, and the play and force of its muscles serve to continue it.

SINGULAR PROPERTY OF THE BALANCE.

The following curious property of the Balance is mentioned by Helsham. If a man placed in one scale, and counterpoised by a weight in the other, press the beam upwards, he will thus cause the scale in which he stands to preponderate.

C. D.

HOW TO FIND THE MAGNIFYING POWER OF TELESCOPES.

Put up a small circle of paper, an inch or two in diameter, at the distance of about an hundred yards; draw upon a card two black parallel lines, whose distance from each other is equal to the diameter of the paper circle. Then view through the telescope the paper circle with one eye, and the parallel lines with the other, and let the parallel lines be moved nearer to or farther from the eye till they seem exactly to cover the small circle viewed through the telescope. The quotient obtained by dividing the distance of the paper circle by the distance of the parallel lines from the eye, will be the magnifying power of the telescope. A little practice is necessary before this experiment can be made with accuracy.

Notices to Correspondents in our next.

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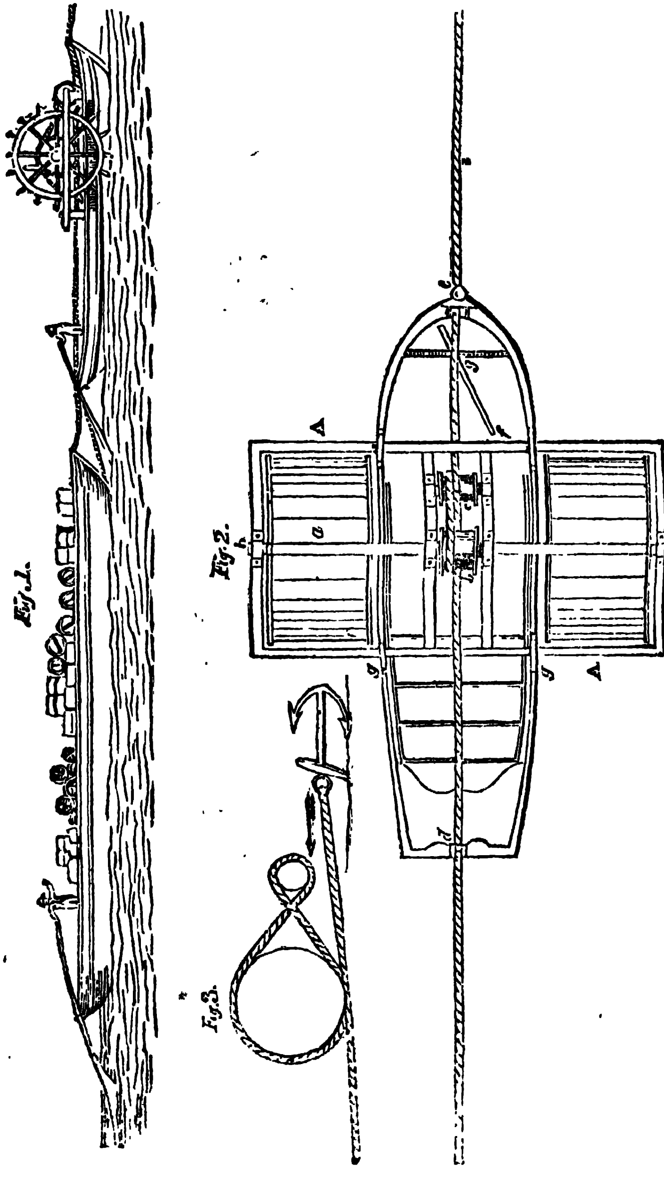
PLAN FOR ASCENDING RAPIDS IN RIVERS.



PLAN FOR ASCENDING RAPIDS IN RIVERS.

The attention of the citizens of Philadelphia has recently been a good deal occupied with a Plan of Colonel Edward Clark, for Ascending Rapids in Rivers (an account of which Colonel Clark has kindly transmitted to us), and thereby improving the navigation of the River Delaware.

It may be necessary, for the information of some of our readers, to mention that the Delaware, from its magnitude, extent, and ramifications, and from the fertility and prosperous state of the country intersected by it and its tributary streams, claims a rank among the most important of the secondary class of American rivers. From the facilities which its navigation affords, as high as tide-water, Philadelphia derives its chief prosperity and greatness. But from the termination of tide-water upwards, and the number of rapids, the benefits to that city of the intercourse with the circumjacent country are at present exceedingly limited and unimportant. It appears, however, from a Report made to the Governor of Philadelphia, by three intelligent surveyors, that there is no fall on the Delaware which may not be made passable with safety.

Colonel Clark's plan for securing an ascending navigation in rivers thus obstructed with rapids, is thus briefly described:—

He proposes to cut, wherever it is necessary and practicable, a channel of sufficient width and depth for the passage of boats, &c. in the bed of the river, past such rapids as may impede their navigation.

When the beds of rivers will not admit of being broken to the requisite extent, he recommends that the water should be collected and confined in channels to answer the same purpose, by means of slightly elevated wing and side dams, inclined and arranged appropriately to secure the object, so as not in the slightest degree to impair the downward passage of arks, rafts, boats, &c.

Buoys are to be stationed and constantly maintained at the head of each rapid, for the purpose of directing the descending craft to the entrance of the channels.

At the foot of each rapid a tow-boat is to be stationed, which, by means of the current acting on paddle-wheels, windlasses, and a chain or cable anchored at the head of the rapids, is to tow the ascending craft or boats over the falls or rapids.

The action of these tow-boats is illustrated by the prefixed engravings.

Fig. 1 is an elevation of the tow-boat with another boat in tow.

Fig 2 is a bird's-eye view of a tow boat, with her appendages.

AA represent the frame-work for supporting the shaft and paddle-wheels.

aa, The paddle-wheels.

b, The windlass.

c, The drum.

dd, Friction rollers.

e, A guide-roller for directing the accession of the chain or cable at the bow of the boat.

hh, Pivot-boxes and pivots of the wheel-shaft.

ii, Chain or rope extended to the whole length of the rapid.

Fig. 3, The manner of passing the rope round the windlass and drum.

A party of gentlemen who went to Trenton to witness an experiment made with the above apparatus, report of it as follows:—

"The machine drew up with ease a Durham boat and a large barge, containing sixteen or seventeen persons, in a rapid part of the falls, at the rate of a mile and a third in an hour. With the same or nearly the same facility it could have drawn up three or four Durham boats, and, by the enlargement of the cylinders or windlasses, and paddle-wheels, the velocity and power could be very considerably increased. After passing the rapids, the boats were drawn with ease into slack-water above The tow-boat is about forty feet long, and nine feet broad. The paddle-wheels are ten feet in diameter, and are furnished with twelve paddles or buckets each, which are about six feet long and sixteen inches broad. The cylinder, or windlass, of the main shaft, is three feet in diameter; and the action of the current on the

paddle-wheels was such as to cause them to revolve twelve times in a minute."

The report of another party states that they witnessed an experiment made by Colonel Clark, on the Mill Rapids on the Susquehannah River, "by which he conveyed or towed over the said rapids, against the current, a keel-boat constructed to navigate the said river, about seventy feet in length and nine feet in breadth, together with a large-sized canoe, fourteen men, and about a half ton of ballast, with a boat of about thirty feet in length, and five 10-12 feet in breadth, supplied with a pair of paddle-wheels. They add their belief that the apparatus "would have towed ten tons in addition to what it did."

Dr. W. B. Ewing, who was present at a third experiment, at the Trenton Falls, says that the "boat, in that instance, ascended with very considerable velocity against the greatest rapidity of the current of the falls, towing after her a large scow, with thirty or forty persons on board; and that, in his opinion, her power was fully competent to have taken up three such scows, loaded in a similar manner."

If there be any places in which the tow-boat cannot be advantageously used, Colonel Clark proposes to construct side-cuts and locks, to extend the navigation past such situations.

Where bars or shoals interrupt the navigation, Colonel Clark proposes to construct wing-dams obliquely across part of the river, so as to flood the water back to a sufficient depth for the passage of boats over them.

The Colonel's other improvements extend principally to the removal of the rocks in the channel of the river, in such manner that the navigation shall become easy and safe at all seasons of the year, except when it may be interrupted by extraordinary natural occurrences, such, for instance, as the prevalence of ice, floods, &c. Where three, two and a half, or even two feet water, can be collected in the channels of rivers, Colonel Clark is of opinion that steam-boats of a light craft may be applied to navigate them; and he is strengthened in this belief from the circumstance that a steam-boat, called the Chambly, of 50 horse-power, 153 feet deck, 30 feet beam, and drawing only three feet water, is at present successfully navigating the shallows of the River Richelieu, in Lower Canada.

THE SCREW QUESTION.

Sir,—Agreeably to what I formerly promised, and being still farther stimulated by T.'s postscript in your last Number, I now sit down to give you my opinion upon that question, which has drawn forth so much wit and good humour from your Correspondents.

Previous to that question being started, I had for a very long time fostered an opinion regarding the superiority which a long screw-driver possesses over a short one, and, to make myself more competent to explain the cause of this superiority, I have had curiosity enough to perform a series of experiments, in order to determine with greater precision how far I may have been correct in that opinion, and these experiments have fully realised all that I had formerly entertained on the subject. I shall first describe to you the nature of these experiments, and then proceed to show how this superior ease, which we feel from using a *long* instead of a *short screw-driver*, can be accounted for.

Into the puppet-heads of a lathe I placed a driver and screw; this screw was placed into a block of hard wood, so as to admit the screw into it when acted upon by the driver. Into the handle of the driver I fixed a lever, and to this lever I attached weights, until I communicated motion to the screw. Now I invariably found this motion to be the same in the short as in the long screw-driver. These experiments were tried by a great variety of screw-drivers of different lengths, and possessing very different degrees of elasticity. All this, you will perceive, is completely at variance with what the generality of artisans must have experienced, and to explain this seeming paradox we now proceed.

That a driver, when in the act of turning a screw, may be considered as a lever of the first and second kinds, of which the axis of the screw is the fulcrum or prop, and the semi-diameter of the handle the longer arm of that lever, I have no doubt; but since both drivers have their handles alike, it appears to me exceedingly erroneous to consider them as a lever at all. Since both the long and short drivers are placed under similar circumstances in that respect, the advan-

tage gained by each being common to both, can prove nothing for or against either; and, as in the case of any other mathematical proposition, this equality may be thrown aside. Hence the existing difference consists only in the elasticity. Suppose, then, the elasticity of the driver to be expressed by the number 20; if the resistance of the screw were expressed by the same number, it is evident that, on applying the driver to it, we would only have to apply a force equal to the elasticity of the driver, so that its reaction would communicate motion to the screw, or at least would produce an equilibrium between the power and resistance; so that, upon the slightest additional force upon the driver, motion would commence in the screw. But since where the points of elasticity end, fracture begins, so in this case we could not impress motion upon the screw. It almost always happens that the elasticity of the driver is greater than the resistance of the screw. Suppose then the elasticity expressed by 30, and the resistance by 12; now, if a force is applied to the driver equal to 5, it is evident that the remaining elasticity and resistance will be exactly expressed by the numbers 25 and 7; and as soon as the remaining resistance, namely 7, is extinguished, and the slightest additional force is applied to the driver, motion will instantly commence in the screw. Now, as after this motion has begun, the driver will still possess a portion of its elastic power equal to 18, minus any indefinitely small quantity, and this remaining elasticity preserves the hand soft and easy in its position, I apprehend that it is from this alone the supposed power arises. What still farther confirms me in that opinion, independent of the above experiments, is, that having no exact method of determining the value of the power impressed upon the driver by the hand (for, according to the physical force employed, the resistance will increase or diminish), we naturally suppose the greater softness and ease which we feel in the elastic driver to be a real increase of its power. As the difference of elasticity, too, exists in a more prominent degree in the long than in the short driver, we become thereby the more susceptible of that superior ease in the one case than in the other. It is from this very reason that two chairmen carry a sedan chair much more easily upon elastic than non-elastic bars; although, to speak correctly, there is no such thing in nature as a perfectly non-elastic body. For the same reason, a man carries a sack of coals with greater difficulty than a bag of flour; and Dr. Franklin declared, that he always lay more at ease in the water than in a feather bed; and for the same reason does the quarrier much more easily move a stone with an elastic bar of wood than with an iron punch or crow-bar. It is no uncommon sight (in Auld Reikie) to see two porters, eager to catch a fare, *running* with their sedan chair, and mutually keeping the step to its hobbling motion. Query, could they do this if the two poles upon which it is carried were much less elastic? Now the ease which we feel, in the cases above alluded to, does not proceed from the one load being lighter than the other (for we suppose them the same weight), but because the body is better enabled to bear the strain of the one than of the other, from its supporting the *softer* body on a greater number of points. Hence we are apt to exclaim, "This load feels easy—I could carry more." The whole, however, is a mere deception, arising from the imperfect manner in which we employ the manual force exerted, or from the want of a more exact method of determining its real value. Few of your readers are unacquainted with optical and acoustical deceptions, and why may not similar deceptions exist in the cases above mentioned? A-propos, and just in the nick of time (O! I mean the nick of the screw), I perceive that I have no less authority than your Correspondent R. N. at page 374, vol. I., who has exactly anticipated me on this subject. When speaking of the wheelbarrows, he says—"I observed, that on stony and uneven grounds a heavy load was very *distressing* to the *arms* and *shoulders*. It therefore occurred to me to apply SPRINGS *to them, whereby the men were enabled to wheel much heavier loads with ease; so much heavier*, THAT I GOT MORE CAPACIOUS BARROWS MADE." He adds, "I have used these spring barrows several years, to the *satisfaction of the labourers*." And now, Mr. Editor, taking the above view of this interesting subject, the fact is, J. Y. has been "sufficiently explicit in the first instance;" see page 126, Number 64, and page 60, vol III.

This property of the elasticity of bodies is absolutely necessary for the preservation of the system; and we cannot sufficiently admire and adore that Being whose omniscient eye foresaw *that* confusion and irregularity which must necessarily exist in a system whose parts are non-elastic. Without this property no machine could possibly exist; for it is beyond the power of man to construct a machine whose parts, when in motion, will harmonize with each other with perfect mathematical precision. There is a continual bending and springing of some part of the machine or other, and were this not the case, the machine must either cease to move, or it must be broken to pieces.

Having said so much, let me, if it be your pleasure, have one word in return to your Correspondent D. H. In——y. He says, p. 126, vol. III.—"If, then, we suppose that the upper part of the driver

should in one revolution pass through three inches, while the lower part should only pass through two inches and a half, the power will be as much greater than it would be if the driver were non-elastic, as 3 is greater than 2½, or the power of the driver would be increased by its elasticity as 6 to 5." Now, Sir, this is what I call nonsense, since the reaction of the force impressed by the hand must exactly return the same force upon the screw, as I have already shown. How, then, can he assert that it will be (according to his hypothesis) as 6 to 5? The thing is absolutely impossible. He adds another absurdity. "If this distance (meaning the distance between the spirals) be stated at one-eighth of an inch, then this power would travel three inches (meaning the upper part of the driver), or twenty-four times as far in the same time as the resistance; the power would therefore be mechanically multiplied 24 times." But let me tell him (although I am only an operative mechanic), that this branch of his philosophical knowledge has nothing to do with the question, since both screws and drivers are affected by the very same law, and consequently nothing can be deduced from them, for they destroy each other in their effects; in short, they are similarly situated as regards each other. Again, the upper part of his driver moves over a space, which he represents by 3, while that of the revolution of the screw moves only through a space equal to 2½. Would not this difference of space, passed over by the upper and lower parts of the driver, increase so as, in the course of a few revolutions, to twist the driver to pieces? Here, then, lies his Goliah, and let Mr. D. H. In——y raise him if he can

I am, Sir, your obedient servant,

NICOL DIXON.

63½, Red Lion-street, Clerkenwell,
December 22, 1824.

Our friend N. D. will find his solution of the question well supported in the following communication:—

SIR,—So much has been said about the Srew-driver or Turn-screw, that it is high time to arrive at some conclusion on this puzzling subject; and I offer my opinion for that purpose, as follows:—

It is fully proved, that if the *lever* which is applied to the object to be turned can be as *conveniently acted on by muscular power*, at or near to one end of ever so long a piece of timber, as at the middle, or the other end, there will be no conceivable difference in the labour requisite to the turning the piece of timber; all that is sought after is a convenient place for "a good hold or purchase" and freedom of action. (Vide your frontispiece to vol. II.) The solution of the Turn-screw question does not lie within the various construction of turn-screws, *but in the manner by which muscular powers* can be brought to act on them. The anatomical formation of the hand, and the small bones which unite it to the fore-arm, as also the two bones of the fore-arm, with all the muscular powers of the whole, are capable of a *vast variety* of *active powers*, and *exactly as many degrees of power*, so that there is scarcely any alteration of position without a variation of power. I argue, therefore, that *it is the increase of power, through convenience of grasp*, which makes the sole distinction between using a short turn-screw and a long one, and produces all the liabilities which your various essays on the subject have so ingeniously explained.

I am, Sir, your obedient servant,

CHARLES HAYTER.

16, Buckingham-street,
Portland-road.

WARMING AND VENTILATING BUILDINGS.

SIR,—There is no subject more worthy the attention of the public than the very ineffectual methods in common use to warm and ventilate our apartments, and the very common complaint of smoky rooms, and draughts produced from the wrong position of doors and windows, which subject us to the alternative of being stifled by the one, or chilled by the other. Indeed I have been often surprised that, among all our modern improvements in buildings, so little has been done with regard to the inconveniences felt under the present system; many methods have, indeed, been proposed for warming our workshops and manufactories, but few of general application to domestic purposes. I am, therefore, induced to call the attention of your numerous Correspondents to the subject, in the hope that some general plan may be adopted for the comfort of us all, as well as from motives of humanity, in putting a stop to that system, so cruel in itself, of employing children to sweep our chimneys. If it was on no other account than this last, I would recommend to the perusal of the public in gene-

ral, some plans laid down in a pamphlet lately published, on the different systems of Warming and Ventilating Buildings, addressed to the economist, the invalid, the desirer of safety, and the lover of comfort, by G. P. Boyce. An extract or two from this production may not be uninteresting; indeed the whole is written in a style that at once commands our attention and convinces us by its reasoning. At page 11, the author observes — "That the present mode of obtaining warmth is defective in an eminent degree, every one, however unwilling to confess himself in error, must be innately conscious. A more bungling and inefficient process was, perhaps, never devised, than that by which it is attempted to raise the temperature of an apartment by means of an open fire in a grate and chimney of the moden construction; nine-tenths of the heat produced by the one being, from the very nature of things, immediately carried off through the channel of the other; and the remaining tenth, slowly communicated to the air of the apartment, is just sufficient to convert every aperture and crevice into a trap for colds, fevers, rheumatism, and all the disorders arising from a checked perspiration."

Again, speaking of combustion, and the necessity of a supply of oxygen to maintain it, he says— "The fire or combustion in the grate is continually drawing to itself fresh supplies of atmospheric air, and consequently the radiation of heat in those directions is completely checked and overcome by the superior force of the cold current, which, as fast as the supply undergoes the calorific process, becomes rarefied, ascends, and is wasted through the above channel of the chimney."

The remarks of the author on the disfiguration of our buildings by the pile of chimneys, always visible, are worthy the attention of the builder and architect.

I shall now conclude this article by remarking, that, if through the medium of your useful publication, I should draw the attention of the ingenious mechanic to a subject well worthy his consideration, I have only done that which a lover of his country should strive to accomplish—the general diffusion of useful knowledge, and the improvement of our arts and manufactures.

I remain, Sir,

Your obedient servant,

G. A. S.

We have looked into Mr. Boyce's pamphlet, and concur entirely with our intelligent Correspondent in the praise which he bestows upon it. It is very sensibly and ably written, and we are tempted to add to the preceding extracts the remarks to which G. A. S. alludes, on the effect of piles of chimneys in disfiguring our buildings; they contain some well-pointed satire.

"The want of artificial warmth must have been early felt by man, and the art of procuring it may, perhaps, claim an antiquity beyond the age of architecture. The half-clad savage of the colder regions, employed all day in the chase, found, at night, the blazing fire necessary to his very existence; and it was to protect this preserver from the vicissitudes and inclemency of a northern sky, that, at a future period, he surrounded it with walls and a roof, and thus became an architect. When the smoke in this confined situation began to produce him annoyance, a central opening in the roof afforded slow egress to the cause of his discomfiture; and his easily satisfied imagination deemed itself to have now reached the summit of domestic enjoyment. Such were the habitations of our forefathers for many succeeding ages; and erections of this primitive structure may even yet be found in the wilds of America, among the mountains of the North, and in the bogs and fens of a sister country. But, as luxury and civilization arose, and buildings began to assume more durable and complicated forms, other modes for the supply of warmth became necessary, and other contrivances to that end were to be introduced. Throughout these changes, the due arrangement

nd disposition of the several fires eem to have been the stumbling-block of our early architects. With some fearful ideas of the consequences to be apprehended from confined smoke, the wide-spreading arches and massy piles they constructed to facilitate its escape, appear, in many instances, to have occupied half the space, and to have cost nearly half the expense of the entire building. Some enormous specimens of this period yet remain, presenting the appearance more of immense natural chasms than of chimneys, frequently exciting the surprise of the antiquary by their unaccountable proportions. The quantity of heat and of unconsumed materials daily wasted through these preposterous cavities, would madden a modern economist; but when lands were to be cleared and forests hewn down, an arrangement which so admirably assisted these ends, by its extraordinary consumption of fuel, could not easily be dispensed with. As woods disappeared, and the means of supporting this waste became more expensive, it was found necessary to contract these vast recesses and erections; so that, after a long contention, the arch of the fire-place no longer vied in magnitude with that of the great church door. In this state the practice has descended to modern times. One slight approximation to a better principle the last century certainly introduced; as, from an attention to the laws which regulate the motion of fluids, it was then discovered that a small chimney, by means of its quicker draught, carried off the smoke quite as effectually as by the sluggish motion in a large one. But the original principle, with all its overwhelming errors, remained unaltered: this quicker draught carried off with it still greater quantities of unconsumed fuel, the beneficial effect of the fire was still circumscribed to a space of a few feet from the grate, and the air necessary to support combustion continued to be drawn into the apartment from the external atmosphere, consequently at such a temperature as completely to neutralize what portion had already received the calorific influence."*

HOUSE ROOFS.

Sir,—I take the liberty of calling your attention to a subject of great importance to the inhabitants of all large cities—the Roofing of Houses. In the East all houses have flat roofs, which are covered with a sort of composition much resembling Roman cement. These roofs are perfectly impervious to water, and form a pleasant terrace on which the inhabitants can sit and enjoy the evening air in fine weather. It has always appeared to me that the introduction of this plan of roofing would be a great improvement in our European cities.

In the first place, it would afford a pleasant terrace during fine weather.

2d.—It would much improve the appearance of a street of houses; for what can be more ugly than large sloping roofs, which expose to view all the unsightly stacks of chimneys?

3d.—It would be a great means of checking the progress of fires; for it is chiefly by means of the present roofs that fires spread with such fatal rapidity; the rafters, slating-boards, &c. being almost as combustible as a stack of faggots. The expense would not be greater, for although the timber of a flat roof requires to be stronger, the diminution of their numbers would compensate for the additional strength and cost.

I shall be obliged if you will call the attention of practical men to this subject.

I am, Sir,
Your obedient servant,
A Traveller.

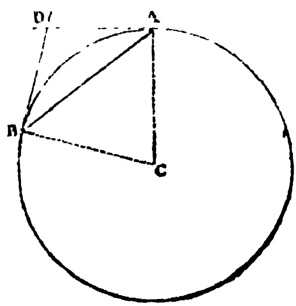
* The deteriorating effects of this system, in an architectural point of view, are well exemplified in the appearance of that otherwise noble building, Somerset House: as seen from Waterloo Bridge, its grandeur seems lost, and its beauty completely disfigured, by the numberless grotesque contrivances by which it has been fruitlessly attempted to carry off the smoke.

MECHANICAL GEOMETRY.—No. V.

(Continued from our last Number.)

THEOREM VII.

If from the two extremities of any chord tangents be drawn to the point where they meet the circle, they will intersect each other at equal distances from the extremity of the chord.



Let AD and BD be two tangents to the points A and B, drawn from the extremity of the chord AB, the point where they intersect at D will make AD equal BD.

From A and B draw AC and BC to the centre of the circle, then we have shown (Theorem v. Part II.) that the angles DAC and DBC are both right angles. Now as AC equals BC, the angles ABC and BAC (by Theorem IV. Part I.) are equal; now if we take these equal angles from the angles DAC and DBC, the remainders of those angles, viz. DAB and DBA will also be equal to each other; hence, in the triangle DAB, the angles at A and B being equal, the sides AD and BD must also be equal (by Theorem IV. Part I.). Hence the tangent AD and BD are shown to be equal, as was required.

COROLLARY I.—Hence, if from the extremities of any chord two tangents are drawn, they will form an isosceles triangle, whose equal angles (at the base) are measured by half the angle the chord subtends, and the angle at the vertex is measured by the supplement of the arc to which the chord corresponds; that is, supposing the chord to include 60 degrees of the whole circumference, the angles the tangent make with the chord will be each 30 degrees, and the angle the two tangents make with each other will be 120 degrees, or a semicircle (180 degrees) wanting 60 degrees.

COROLLARY 2.—Hence, if the tangents are perpendicular to each other, the chord from which they are drawn is a chord of 90 degrees, and the two tangents with the two radii drawn from their extremities to the centre of the circle form a square.

Note.—We will now deduce some practical Problems from the foregoing Theorem.

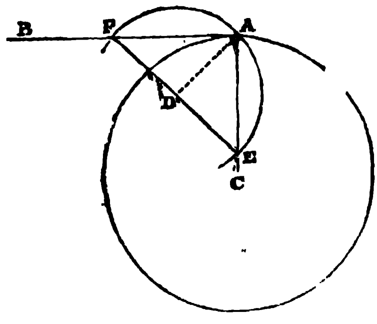
PROBLEM VIII.

To draw a *tangent* to a circle from any given point.

This Problem admits of two cases.

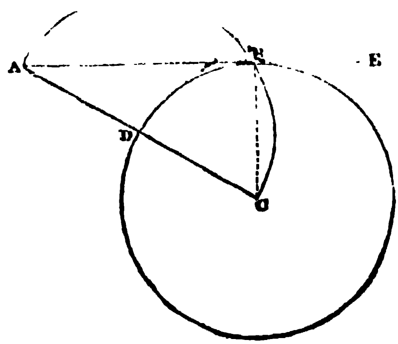
CASE 1.—When the point is in the circumference of the circle.

Let A be the given point from which it is required to draw a tangent,



From A draw the radius AC to the centre; then from A erect the perpendicular AB (by Problem II. Part II.) and it is the tangent require' Thus assume any point, as D, and with a radius equal to DA describe the circle FAE, and through E and D draw EDF cutting EAF in F; through F draw AFB, and it is the tangent required.

Case 2.—When the point is situated without the circle.



Let A be the given point situated without the circle; BD, to which we are required to draw a tangent.

From A draw the line ADC to the centre of the circle; then bisect the line AC (or divide it into two parts) in D (by Problem VII. Part II.); then, with DA or DC as radius, describe the semicircle ABC, and where this cuts the circle BD in B, draw the line BA; then is BA a tangent to the circle BD, and drawn from the point A, as required.

Note.—We may here observe that the truth of this Problem is manifest, for the angle BAC in the first case, and ABC in the second, is the angle in a semicircle, and, consequently, (by Theorem III. Part II.) it is a right angle, or the lines are square to one another; and (by Theorem V. Part II.), when that is the case, the line AB is a tangent to the circle.

I shall here also take occasion to remark, that though AB is, *strictly speaking*, a tangent to the point B (see last fig.), yet, if AB is produced to E, the whole line is mechanically understood to be the tangent line to the point B of the circle; but when the tangent is used as a line for the purpose of comparing the relative value of the sides of triangles, for the purposes of mensuration, &c. the line AB is always understood to terminate at the circumference in the point B, and is said to be a tangent of so many degrees, according

to the length of it when compared with the radius of the circle; thus, in the figure above, if the angle BCA is an angle of 60 degrees (for instance), the tangent BA is said to be a tangent of 60 degrees, and the line AC is called a *secant* of 60 degrees.

G. A. S.

(*To be continued.*)

Sir,—Your Correspondent who signs "A Ship-Owner," recommends *salt* as a remedy for the Dry Rot. I was an apprentice in the dock-yard at this port, when a famous dry rot doctor of the day, a Mr. Jackson, pretended to make our ships last for ever, by putting salt of different kinds in holes bored into their timbers; but it was found to make the ships damp, destroyed the iron, and injured the health of the seamen; besides, it was considered that the ships decayed faster from being so treated. I worked here when a boy, in the year 1772, on the Princess Royal, of 90 guns, that was pickled in this way. I find all the facts stated in detail in an excellent book "On Preserving the Navy," by a Mr. Knowles.

As to Mr. John Burridge's opinion of winter-felled timber, "it is as old as the hills." For my part, I have seen a great deal of timber, and have watched its duration, and believe, if it is of a good quality and well-seasoned before it is used, it signifies but little at what time of the year it is felled. I have seen very good summer-felled timber and very bad winter-felled timber, and the contrary; but I am firmly of opinion that it is a very bad plan to strip the timber before it is felled: some so treated, now in this dock-yard, proves this.

As Mr. J. Burridge was born and bred in this town, we know "he is not of the race of Solomon;" but how, with his eyes open, he could say that the Waterloo, of 80 guns, in ordinary here, was rotten, I am at a loss to know. I am an old shipwright, and, as such, can assure your readers that there is not a sounder ship in the navy, and is fit for any service in any part of the world.

The Nelson, certainly, is not in a good state; but how is this? Chiefly from winter-felled American timber being worked into her; it is this timber which is rotten, while the summer-felled English timber is good. The rotten timber is of that sort with which Mr. J. Burridge threatens "the annihilation of the ships of England," by its durability in American ships of war.

I am, Sir,

A Superannuated Quarterman.

Portsmouth, Dec. 21, 1824.

THE BALANCE.

Sir,—I am surprised at seeing your Correspondent "C. D." page 221 of your last Number, mention, as a singular property of the Balance, that a man in one scale, counterbalanced by a weight in the other, by pressing the beam upwards, will cause the scale in which he stands to preponderate. The reason of this is so clear that it would, indeed, be singular if it were otherwise. But, to produce the effect stated, the pressure must be applied between the pivot and the point of suspension. Suppose that he presses with a force of 30 lbs. midway between the pivot and the point of suspension, he throws 30 lbs. additional weight on the scale, whilst his pressure upwards will produce a force of 15 lbs. only, on account of the leverage. The effect of a downward pull at the same part of the beam will be to cause the other scale to preponderate. But if the pressure could be applied beyond the point of suspension as far as that point is beyond the pivot, then a power of 30 lbs. will give an effect of 60 lbs.

I am, Sir,

Yours respectfully,

G. B.

Rotherhithe-street,
Dec. 27, 1824.

OIL AND COAL GAS.

SIR,—Knowing the object of your Magazine to be the diffusion of useful information, commercial as well as *mechanical*, I have taken the liberty to send you the following practical observations on Oil and Coal Gas. Having had considerable experience in coal, and, for some time past, in oil gas, I have been at some pains to ascertain their relative cost, proportion of light, and consumptive difference; and judging that an investigation of this nature, and particularly a practical one, would be acceptable to some of your readers (especially those persons who are contemplating the introduction of gas into their establishments), I have, for their information, transmitted this account. It must be observed, however, that the rates here used are Manchester rates; of course, this calculation of difference in cost will not be correct where fuel is dearer, yet, by taking into the account all local differences, a true statement may readily be made.

OIL GAS.	COAL GAS.
One gallon of good whale-oil will make nearly 77 cubical feet of gas; this, at the rate of 2*s*. 3*d*. per gallon, is 29*s*. 2*d*. for 1000 feet.	One pound of Wigan kennel coal will make, at the lowest calculation, three feet and a half of gas; this, at the rate of 10*d*. for 112 pounds, is 2*s*. $1\frac{1}{2}$*d*. for 1000 feet.
Imparts very little heat; is on this account preferred by some.	Emits considerable heat; so much so, that where much gas is used and much heat wanted, the saving is great.
Is exceedingly weak, and liable to be extinguished by agitation; persons passing hastily, the closing of a book, or motion of machinery, will effect this, if not enclosed in a glass chimney.	Not subject to this inconvenient defect—a dangerous one too, as re-ghting is attended with considerable risk.
For every 1000 feet of gas evaporated, 10 lbs. of coke is used for volatilizing, and 80 lbs. of coal for heating the retorts.	For every 1000 feet of gas made, 20 lbs. of coke are gained over and above what is wanted for heating the retorts. None but the best Wigan kennel coal will produce this quantity, and it is necessary that the retorts should be semi-elliptical, and set up on the oven plan, as most gas may be obtained with the least fuel by this means.
Holds in solution a considerable quantity of essential oil, which chokes up the horizontal jet frequently.	Not subject to this inconvenience.
Emits considerable quantities of lamp-black, which horizontal jets cannot consume; the Oil Gas Companies therefore recommend vertical jets (a great disadvantage, as the horizontal lights give so much more light downwards) and glass chimneys, for the purpose of consuming the lamp-black, and preventing the apertures being clogged with the oil.	Is not so subject to smoke or choking up of the burners.

OIL GAS.	COAL GAS.
Light irregular, varying from 2.5 down to 1.5 compared with coal-gas.	Light regular and strong.
Free from sulphuretted hydrogen.	May be freed from sulphuretted hydrogen by washing in sulphuretted acid.

I have stated, in this comparison, that only three and a half feet of gas are made from one pound of kennel coal; but our last average for the winter season was three and three quarters feet from one pound of kennel; however, three and a half feet was the average before the retorts were set up on the oven plan, and with Mr. Worthington's exhausting apparatus, which draws off the gas to prevent decomposition in the retorts (a very ingenious and self-acting machine), they produce from five to five and a half feet of gas from one pound of kennel coal. A number of these are now at work in this neighbourhood, and may be seen at the following places :—

Messrs. Burton, Middleton.
Tod and Hough, Newton Heath.
Roe and Duncalt, Hollinwood.
Mosely and Howard, Disley, &c.

From the above results it appears (allowing the consumption of oil compared with coal-gas as 1.5 to 1, which is the utmost, and one gallon of oil to produce 77 feet, and one pound of kennel coal three and a half feet of gas) the same proportion of light may be obtained from each at the following rate :—oil-gas, 29*s.* 2*d.* coal-gas, 6*s.* 9*d.*

In making this calculation I have not taken advantage of the quantity of gas made by Mr. Worthington's apparatus, nor of the saving in generating the gas, as mentioned above, in coal and coke; in this case the comparison will be as 29*s.* 2*d.* to 4*s.* 2*d.* or 7 to 1.

The advantages which oil possesses over coal gas are these—the generating apparatus and gas-holder occupy but two-thirds of the space, and may be laid down at two-thirds of the cost of coal gas: oil gas is free from sulphuretted hydrogen, and makes less residuum, though that is considerably more than is represented by the advocates for oil gas ; as for the mephitic odour, there is little difference.

I am, Sir,
Your obedient servant,
R.

Manchester.

REPORT OF THE ROYAL DUBLIN SOCIETY IN FAVOUR OF OIL GAS.

At a Meeting of the Royal Dublin Society, on the 9th of December last, Mr. Flood presented the following Report from the Committee appointed to examine into the expediency of introducing Gas Light into the different departments of the Royal Dublin Society :—

" Your Committee have to report, that proposals have been laid before them from the Hibernian Coal Gas Light Company, offering to supply coal gas, per metre, at one shilling and sixpence per hundred cubic feet.

" That proposals have also been laid before them from the Dublin Oil Gas Light Company, offering to supply oil gas, per metre, at five shillings British per hundred cubic feet.

" That your Committee have consulted some of the most eminent scientific writers who have published their opinions on the different gases, and find that the illuminating power of oil gas, in comparison with coal gas, is, at the lowest ratio, as 1 to $3\frac{1}{2}$, *i. e.* that one cubic foot of oil gas will give as much light, and will burn as long, as three feet and one-half of coal gas. That the oil gas does not injure metallic substances, furniture, paintings, gildings, or such like, and your Committee are decidedly of opinion that oil gas alone ought to be introduced into these premises.

" Your Committee, therefore, recommend that oil gas lights be forthwith fitted up on the plan and in number as follows, viz.—(Here follows an enumeration of lights, &c.)"

RAILWAYS.

(*Continued from p.* 213.)

In our last we gave a brief account of the nature and construction of Railways. We now pursue our inquiry into the effects of a determinate force of traction employed on railways and canals.

In calculations respecting the power of a horse exerted in different modes, errors often arise from considering this power as a constant quantity, which it is not. At a *dead pull* an ordinary horse exerts a force of traction equal to 150 pounds: this is reduced to less than one-half when he travels four miles an hour; to one-ninth part when he travels eight miles an hour; and at twelve miles an hour his whole strength is expended in carrying forward his own body, and his power of traction ceases. It is supposed here that the horse performs pretty long journeys. When travelling very short stages, he may exert a force considerably greater; and his power of traction may perhaps cease only at a velocity of 15 or 16 miles an hour. But in common cases a velocity of 12 miles may be taken as the maximum; and, for the convenience of calculation, the dead pull may be taken at 144 pounds. Adopting, then, Professor Leslie's rule, the force of traction at any degree of velocity (v) will be $=(12-v)^2$. Thus, the force exerted, at two miles an hour, will be 100 pounds; at four miles, 64 pounds; at six miles, 36 pounds; at eight miles, 16 pounds; and at ten miles, only 4 pounds. Steam-engine makers assume a horse-power to be equal to a weight of 180 or 200 pounds, but this is to be considered merely as an arbitrary and conventional standard, adopted for a particular purpose. It is necessary to keep this general conclusion in view, when we speak of the application of horse-power to the traction of loaded waggons and vessels.

The resistance to the motion of a vessel in the sea or a canal, is of an extremely different kind from that which a carriage of any kind experiences upon a common road or a railway. In the former case it arises from the pressure of the water on the bow and sides of the vessel; in the latter, from the friction of the axle in its box, and that of the rim of the wheel on the gravel or iron rail. The motion of the body in both cases is resisted also by the air; but this resistance, which is small in amount, generally speaking, we shall throw entirely out of view in the first instance, in order to simplify our calculations.

On a well-made road a horse will draw a load of one ton, in a cart weighing 7 cwt., at the rate of two miles an hour. (Leslie's Elements, p. 253.) The whole strength of the horse is exerted in overcoming the friction. On such a road, therefore, a force of traction of 100 pounds moves a weight of 3000 pounds, or the friction is 1-30th part of the load (the cart included).

On a railway of the best construction, it has been shown in our former paper, that a horse travelling at the same rate of two miles an hour draws 15 tons, including the vehicles. In this case, then, a power of traction of 100 pounds moves a weight of 33,600 pounds; the friction of course is 1-336th part, or, in round numbers, 1-300th part of the load.

On a canal, a horse travelling at two miles an hour draws 30 tons in a boat weighing probably 15 tons.* Reducing the ton to 2000 pounds, for the sake of round numbers, as in the last calculation, we find here that a power of traction of 100 pounds moves a mass of 90,000 pounds, or the resistance which the water opposes to the motion of the vessel is equal to 1-900th part of the load or entire weight. At sea, where the water-way is of unlimited breadth, the resistance is probably one-third less; but as a compensation for this, when steam power is employed, there is probably a loss of one-third, in consequence of the disadvantageous mode of its application.

We see, then, that the effect produced by the draught of a single horse is ten times as great upon a railway, and thirty times as great upon a canal, as upon a well-made road. Yet a railway costs only about three times as much as a good turnpike road,† and a canal about nine or ten times; and the expense of keeping the railway and canal in repair is probably less in proportion to the original outlay than in the case of a road. It is obvious, then, that were railways to come into general use, two-thirds or more of the expense of transporting commodities would be saved. With regard to the comparative advantages of canals and railways, so far as the present facts go, we may observe, that if a horse-power effects three times as much upon a canal as upon a railway, the canal costs about three times as much, and will of course require nearly the same rates or *dues* per ton to make the capital yield the same interest.

But here it is of great importance to recollect, that this computation refers solely to a velocity of *two miles an hour.* If the friction which impedes the motion of a car or waggon, and the resistance

* Boats in some cases carry only 15 or 20 tons; in others 35 (as the coal boats on the Union Canal): but in the one case they travel quicker, and in the others slower, than the rate mentioned.

† In Mr. Telford's estimates for portions of new road between Edinburgh and Woolier, we find the expense to be from 1000l. to 1100l. per mile, including the price of the ground.

which the water offers to the progress of a ship, were governed by the same laws, the same conclusions would hold true, whatever the velocity might be. But this is far from being the case, as we shall presently see. In illustrating this point, it will be convenient, instead of estimating effects by the variable measure of a horse-power, to refer to a determinate and constant force of traction of a given amount. We shall therefore assume, that the body to be moved is urged forward by a force exactly equivalent to a weight of 100 pounds, suspended over a pulley at the end of the plane on which it moves.

First, with regard to the motion of a body in water. It is deduced from the constitution of fluids, and confirmed by experiment, that the resistance which a floating body encounters in its motion through the fluid is as the square of the velocity.* Now, taking as a basis the known effect of a force of traction of 100 pounds at two miles an hour, let us ascertain what force would move the same body at a greater velocity. On a canal, or arm of the sea, we have seen that a body weighing 90,000 pounds is impelled at the rate of two miles an hour by a force of 100 pounds; therefore, to move the same body,

At 4	miles an hour,	will require	....	400	pounds
At 6	ditto,	ditto,	....	900	do.
At 8	ditto,	ditto,	....	1600	do.
At 12	ditto,	ditto,	....	3600	do.

Or conversely,—

100 pounds moves	90,000 pounds	at 2	miles an hour,
	or 22,500	at 4	do.
	or 10,000	at 6	do.
	or 5,620	at 8	do.
	or 2,500	at 12	do.

Hence we see, that when we have to contend with the resistance of water, a great increase of power produces but a small increase of velocity. To make a ship sail *three* times faster, for instance, we must employ *nine* times the power; and to make her sail *six* times faster, we must employ no less than *thirty-six* times the power. Let us suppose, for example, that it were required to determine, since one horse draws a boat loaded with 30 tons at two miles an hour, how many horses would draw the same boat at four miles? We find, first, that since the boat is to move *two* times as fast, it will require *four* times the absolute amount of power, or 400 pounds. But a horse moving at four miles an hour pulls only with a force of 64 pounds. Of course, it would require six horses to exert a power of 400 pounds, and move the boat at the rate proposed

Let us now see what amount of power will produce corresponding effects upon a railway. And before we make more particular inquiry, let us suppose that the retardation occasioned by friction, instead of increasing as the square of the velocity like the resistance of a fluid, increases in the simple ratio of the velocity. We have seen, then, that a force of traction of 100 pounds, upon a level railway, moves a body weighing 30,000 pounds at the rate of two miles an hour. We may hence calculate the effect produced by any greater amount of power:—

30,000 pounds are moved	at 2	miles an hour by a power of	100	pounds
	at 4	by	200	do.
	at 6	by	300	do.
	at 8	by	400	do.
	at 12	by	600	do.

Or conversely,—

A power of 100 pounds moves	30,000	pounds	at 2	miles per hour,
	or 15,000	do.	at 4	
	or 10,000	do.	at 6	
	or 7,500	do.	at 8	
	or 5,000	do.	at 12	

Hence we see, that though a moving force of 100 pounds produces three times as great an effect upon a canal as upon a railway *at two miles an hour*, this superiority of the water conveyance is lost if we adopt a velocity at six miles an hour; and at all greater velocities, the same expenditure of power will produce a

* See Playfair's Outline, I. 198; Leslie's Elements, section vii.; article *Resistance*, Encycl. Brit.

greater effect upon a railway than upon a canal, a river, or the sea.

This calculation proceeds on the hypothesis, that the friction increases in the simple ratio of the velocity. Such was the opinion of Ferguson, Muschenbroeck, and some other writers; but the more recent and accurate experiments of Coulomb and Vince have overthrown this doctrine, and established conclusions extremely different, of which the following is an abstract*:—

1. The friction of iron sliding on iron is 28 per cent. of the weight, but is reduced to 25 per cent. after the body is in motion.

2. Friction increases in a ratio nearly the same with that of the pressure. If we increase the load of a sledge or carriage four times, the friction will be nearly, but not quite, four times greater.

3. Friction is nearly the same whether the body moves upon a small or a greater surface; but it is rather less when the surface is small.

4. The friction of rolling and sliding bodies follows nearly, but not precisely, the same law as to velocity; and that law is, that *the friction is the same for all velocities*.

It is with this last law only that we have to do at present; and it is remarkable, that the extraordinary results to which it leads have been, so far as we know, entirely overlooked by writers on roads and railways. These results, indeed, have an appearance so paradoxical, that they will shock the faith of practical men, though the principle from which they flow is admitted without question by all scientific mechanicians.

First, It follows from this law, that (abstracting the resistance of the air) if a car were set in motion on a level railway, with a constant force greater in any degree than is required to overcome its friction, *the car would proceed with a motion continually accelerated, like a falling body acted upon by the force of gravitation;* and however small the original velocity might be, it would in time increase beyond any assignable limit. It is only the resistance of the air (increasing as the *square* of the velocity) that prevents this indefinite acceleration, and ultimately renders the motion uniform.

Secondly, Setting aside, again, the resistance of the air (the effects of which we shall estimate by-and-bye), *the very same amount of constant force which impels a car on a railway at two miles an hour, would impel it at* 10 *or* 20 *miles an hour*, if an extra force were employed at first to overcome the *inertia* of the car, and generate the required velocity. Startling as this proposition may appear, it is an indisputable and necessary consequence of the laws of friction. In fact, assuming that the resistance of the air were withdrawn, if we suppose a horizontal railway made round the globe, and the machine (supplied with a power exactly equivalent to the friction) to be placed on the railway, and launched by an impulse with any determinate velocity, it would revolve for ever with the velocity so imparted, and be in truth a sort of secondary planet to our globe.

Now, it would be at all times easy (as we shall afterwards show) to convert this accelerated motion into a uniform motion of any determinate velocity; and, from the nature of the resistance, a high velocity would cost almost as little, and be as easily obtained as a low one. For all velocities, therefore, above four or five miles an hour, railways would afford facilities for communication prodigiously superior to canals or arms of the sea. Indeed, there is scarcely any limit to the rapidity of movement these iron pathways will enable us to command; and we cannot give a better idea of the astonishing power they put into our hands, than by referring to the remark of Dr. Young, quoted in our last. What he states is strictly true, that the resistance of the air, which, with the velocities and powers of traction we now commonly employ, is an element that may be entirely neglected, would then become the principal retarding force. We need scarcely add, that the question of time or velocity, rightly considered, involves every thing connected with the mercantile advantage of different modes of communication.

We have here considered the subject in a purely theoretical light, leaving it to the engineer to find the means of giving effect to the truths we have stated. We shall enter into various details in a future paper, and touch upon some points of a practical nature. In the mean time we think it right to say, that the conclusions we have announced are strictly conformable to experiments carefully made by Vince and Coulomb; but as there are anomalies in the doctrines regarding friction, and as the velocities employed in the experiments alluded to were much lower than some that are likely to occur in railway communications, we do not take upon us to guarantee the literal accuracy of the principles laid down as applicable to every possible velocity. We certainly believe that

* Leslie's Elements, p. 188, &c.; Playfair's Outlines, I. 88, &c.; Journal de Physique, 1785; Philosophical Transactions, 1785. Dr. Brewster has given the results of Coulomb's experiments in a tabular form, in the article *Mechanics*, in his Encyclopædia.

the conclusions founded upon in our calculations will hold true at all velocities whatever, and they are stated, without limitation, by the most profound mechanicians, Leslie, Playfair, Young, &c.; but we thought it right to mention a circumstance which some may consider as materially affecting their universal application.

(To be continued.)

CORRESPONDENCE.

C. G. D.—Moor is referred to our 56th Number, where we believe he will find the information he requires respecting the Columbus. We thank him for his other hints.

We have had what C. H. suggests for some time in contemplation.

G. A. S. and Nicol Dixon will please send to our Publishers', on Monday, for letters addressed to them.

Mr. Horrel may be supplied regularly with our Numbers, by ordering them through any Bookseller in Exeter.

T. M. B.—We *have* an objection, and a very good one, to answering his Inquiry—we cannot tell, nor can any body for us. But why does our Correspondent hang thus on the skirts of the question? Since he cannot controvert a single one of the facts on which we have rested our censure, a modest silence would be discreet. On other subjects we shall always be glad to hear from him.

A Correspondent, from whom we last heard under the signature of "A Lover of Justice," favoured us some time ago with a paper on London Improvements, which has unfortunately been lost or mislaid. Can he favour us with another copy?

Absence from town prevented our attending to Mr. Ryder's request before the receipt of his last.

Publico's suggestion is a good one, and will enable us to give one more feature of utility to our work.

G. M. H——n's letter of the 31st of August had fallen aside, but shall now have an early place.

Communications received from—Mr. Davies—R. H.—G. N——d—R.—B. N. —G. P.—R. Dowden—E. B.—A.—B. K. —T.—Mr. Turner—G. Thurnell—P. Smith—M. W.—A. Z.—S. Norris—A Subscriber at Hull—T. R. Smart—Carlos—W. J. C.—T. G.—Anti-bias—G. G. —A Constant Reader—H. Gee—L. D.—T. Black—Scrutator—G. F.—W. White —Catherine—J. Nettleton—Fancy—D. P. Q.—Melior—Inglecheek.

ERRATA.

In the title to Mr. Joyce's article in our last Number, for "Recovering Fermented Liquors when Soured," read, "Preventing Fermented Liquors from passing into the Acetous or Sour Stage."

SIR—I have this day received the 67th Number of the Mechanics' Magazine, in which I find inserted a request of mine (No. 78), for some of your Correspondents to furnish a correct Rule for calculating Running Water; but owing to an inadvertence in printing, the rule which I observed was not correct, and is unintelligible. It should stand thus:—"$5,3472\,AT\sqrt{H}$, calling A the area of the aperture in feet, T the time, and H the depth of the aperture in feet; this (says the writer), reduced in the ratio of the $\sqrt{2}$ to 1, will give the true quantity discharged, nearly." But, to prevent the possibility of a mistake, it may be expressed thus:—5,3472 multiplied by the area of the aperture in feet, and this product multiplied by the time in seconds, and this again by the square root of the depth in feet, and the product thus obtained reduced in the ratio of the square root of 2 to 1, will give, &c. Permit me to add, that I am perfectly acquainted with the theory of the above rule; but what I want to know is, the rule in use among engineers for this purpose, by which I know they do calculate the quantity very accurately. If none of your Correspondents should feel disposed to answer this question, perhaps some of them will be kind enough to inform me in what treatise on Hydraulics I am likely to find the required information.

Your obedient servant,

Dec. 14th, 1824. AQUA.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 72.] SATURDAY, JANUARY 8, 1825. [Price 3d.

NEW CYCLOIDAL CHUCK.

Fig. 1.

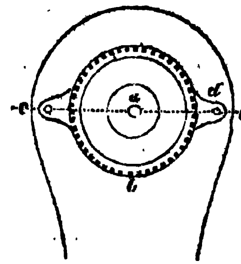


Fig. 2.

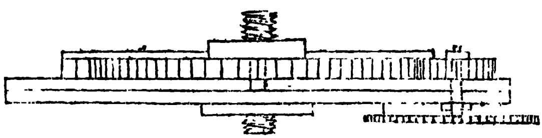
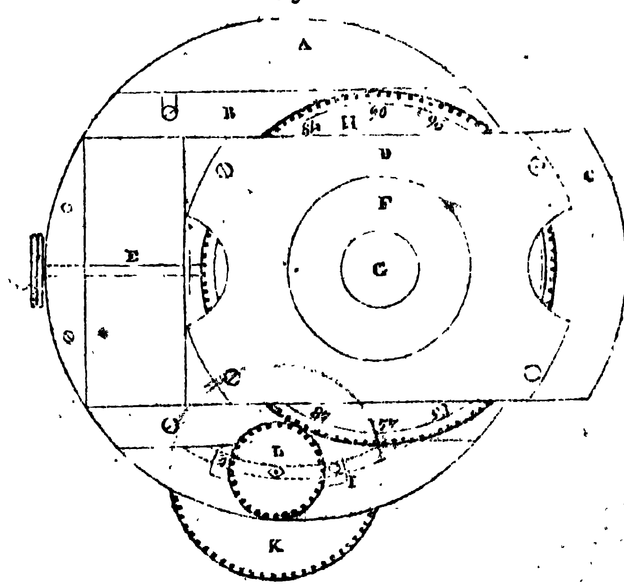


Fig. 3.



CYCLOIDAL CHUCK.

Sir,—Some time ago, one of your Correspondents asked how a Cycloidal Chuck (for ornamental turning) is constructed. I never heard that such a thing had been made; but, on a little reflection, I felt convinced it might be, and would produce a very great variety of beautiful patterns. I have looked in vain in your subsequent Numbers for a reply to your querist, and in the meantime, as my leisure would permit, have endeavoured to reduce my own ideas to practice. The result has been the completion of an instrument which I think correct in principle, and which works to my entire satisfaction; and I shall feel much obliged to any of your readers for suggestions for its improvement and perfection.

Description.

Fig. 1 exhibits a portion of the face of the lathe; *a* is the mandrill; *b*, a brass cog-wheel, bolted to the head by the bolt, *c*, the wheel having been previously soldered to a piece of thin iron, with a projection on each side, *d*.

Fig. 2 is a profile view of the lathe.

Fig. 3 represents the face of the chuck.

A is a circular iron plate, 3-16ths of an inch thick, carefully and accurately turned.

B, Plates for forming a groove for the principal sliding plate, C.

D, A cover for the principal wheel of thin iron, supported by four feet of brass beneath the four corner screws.

F, A piece of iron carrying the screw, G, upon which the work is to be fixed. This iron is turned with a pivot that goes through the large brass wheel, H, to which it is firmly soldered, and this pivot turns in the principal sliding plate, C. As the socket in the sliding plate is nicely drilled in the centre in the lathe, and the circle in the covering plate, D, is also turned out after it has been fixed in its place, so the wheel must revolve with perfect accuracy, and without any shake, having been itself carefully finished between two dead centres.

H, The principal wheel, cut accurately with 96 teeth, which are numbered upon it. If a catch-spring were added to the chuck, in this state it would form a strong eccentric chuck; and it would be easy to make it answer for an oval chuck, by longitudinal perforations in the foundation-plate, through which two lips might move upon the eccentric circle fixed to the head of the lathe.

I is a piece of steel, which has a corresponding one on the back of the chuck, to which it is strongly screwed, and through both of which a hole is drilled for the axis of the wheel, K, which axis carries the driving-wheel, L. There is a concentric perforation in the plate of 5-16ths of an inch in breadth, which allows the two last-mentioned plates, with the wheels they carry, to follow the great wheel, H, however far from the centre it may be set.

K is a wheel on the back of the plate, cut with 72 teeth. It is twice the diameter of the one fixed upon the head of the lathe, which is of course cut with 36 teeth. When, therefore, the chuck is screwed into the mandril, the wheel, K, revolves *once* on the fixed wheel, while the mandril revolves *twice*. The small face-wheel has 24 teeth, and is one-fourth the diameter of the great wheel, H; therefore that revolves *once*, while the mandril has turned *eight* times, and an accurate circle of eight cycloids of any diameter will be traced. By having small driving-wheels of different numbers, proper proportions of 96, the number of cycloids will be greater or less at pleasure, and may be cut nearer or farther from the centre, one within another; and by taking off the small driver, and moving the great wheel forward or backward any number of cogs, the cycloids will intersect each other with a beautiful and endless variety of forms. By making the small plates, I, sufficiently long to carry another small wheel, which I have done, upon a fixed pivot; all the patterns and cycloids are reversed. But I have added mine to a rose-engine, to which I had previously adapted a drill apparatus, so that I can form the cycloids with any of the patterns upon that, or with close, wide, regular, or irregular patterns of intersecting circles of any diameter, and, had I had sufficient forethought to have made this chuck answer for oval work, all the beautiful combinations of ellipses, either simple, figured with the rose-engine, or worked in cycloids; or, in short, the kaleidoscope itself hardly can afford a more endless variety of symmetrical forms than it would have done.

I am, Sir, &c.

******.

Norton, near Stockton,
25th Oct. 1824.

P.S. I scarcely need to add, that the lathe with this chuck must be worked with a slow hand-motion.

LONDON IMPROVEMENTS.

Sir,—Amongst the various improvements that are now in agitation for the benefit of the metropolis, I am

sorry to perceive that no steps are, as yet, taken to prevent one of the most serious inconveniences that the City of London has so long had to complain of, and which is a disgrace to a civilised people. I allude to our cattle market at Smithfield, where oxen and sheep are driven weekly through the most populous streets for sale, to the great annoyance and danger of every passenger; in addition to this evil, these animals, which are necessary to our existence, are subsequently separately taken to every private butcher's shop to be slaughtered, and not unfrequently hunted through narrow streets, with the utmost ferocity and cruelty. Every Englishman who has been at Paris cannot fail to have observed the wise regulations that are adopted by the French Government to prevent this intolerable nuisance. *Abattoirs*, or slaughter-houses, on a large scale, have been built, and are situated in various directions at the entrance of the capital; that at Montmartre extends in length 179 fathoms, 4 feet, 6 inches; its breadth is 64 fathoms, one foot. In the middle of several court-yards, watered by means of the River Ourcq, stand four sheep-cots and four oxen-houses, as well as commodious buildings for the slaughter of cattle. This spacious edifice was constructed under the direction of M. Poidevin, the architect. Exclusive of this, there are several other establishments of a similar description, and on an equally large scale.

With what facility, were a similar plan once adopted in London, might we not imitate the wise regulation of our neighbours, and which would be more particularly beneficial to our commercial city, already thronged to excess with inhabitants and passengers pursuing their industrious daily avocations. If, in the east and west, north and south directions of the metropolis, similar slaughter-houses were erected, and the cattle market removed to some more convenient and spacious ground off the stones, we should no longer witness the disgraceful scenes that daily occur; such public buildings would at the same time, as at Paris, be an ornament to the outskirts of the town, and we should avoid the disgusting objects that now meet our eye in every direction.

If we excel our neighbours in the comforts of our dwellings, the paving and lighting of our streets, the abundant sources of water which flow through innumerable channels into our houses, and many other luxuries unpractised or neglected by them, it is singular that, in the instance above alluded to, we should be so far behind them. With very little trouble, plans and drawings of these buildings in France might be obtained; and as our capitalists, at present, seem determined to set no limits to the number of useless buildings that remain untenanted, it might not be a bad speculation to employ a few thousands in erecting *Abattoirs*, which would not only be a real advantage to society, but ultimately would, doubtless, prove of great benefit to themselves.

If a certain respectable Member of Parliament, who has humanely taken up the cause of animals who are cruelly treated in the streets, would strenuously pursue an object of greater magnitude, in proposing a Bill for the better regulation and erecting slaughtering-houses on a national scale, he would indeed be entitled to the thanks of the community at large, and deserve well of his country. Until some such measure is adopted, the voice of a private individual will be but of little avail; this will, however, I trust, not prevent your dedicating a page in your useful Magazine to promote so desirable and beneficial an object.

I am, Sir, with esteem,

Your most obedient servant,

AN AMATEUR SUBSCRIBER.

AN ANIMAL CLOCK.

The note, of which the following is an abstract, was sent to the Society of Natural Sciences of Switzerland, and is inserted in the Bibliothèque Universelle, vol. xxvii. page 160.

Mons. Chavannes, whilst residing during last summer at Wuarrens, near Echallens, had occasion to hear some account of a man, who, without any uncertainty or mistake, could indicate the precise hour by day or night, and even the minutes and seconds; and this, it was said, he did by consulting his pulse. Induced by these reports to make close inquiry as to their foundation, he visited the man and obtained the following results:—

His name is Jean Daniel Chevalley, aged 67 years. In his youth, the ringing of bells and vibrations of pendulums constantly attracted his attention, and he gradually contracted a habit of counting isochronous vibrations, and displayed considerable ability in calculations. When strong enough, he took pleasure in sounding the bells at school and church; and in his attention to town and church clocks, observed that the beats were 20 or 23 per minute, but more particularly 20, counting from the moment of departure to that of return. After this he endeavoured to force his attention to the preservation, as long as possible, of an *internal movement*, similar as to the extent of time and number of vibrations. "At first," he says, "by adding 20 vibrations to other 20, or minute to minute, he could easily arrive at the conclusion of an hour, and mark all the subdivisions which he wished, and that without confusion; but the thoughts and corporeal occupations suffered by this attention. By degrees I was able to count whilst thinking and acting; but I could not proceed far, because my mind, making a certain effort for a length of time, though but slightly sensible to myself, became fatigued, and dropped the chain of calculation. Nevertheless, in 1789, I succeeded in acquiring the invariable possession of this faculty, which has never since left or deceived me."

He was then 22 years of age, and occupied at a school; but, in consequence of some singular habits, as that of sounding bells, and of some mystical notions he had acquired, and also certain disputes about the correction of the village clocks, he was dismissed, and went to his mill, where, continuing to sound his bells and make his clocks strike, he was nick-named the Mummy of the Mill.

Being on board the steam-boat on the lake of Geneva (July 14, 1823), he soon attracted attention by his remarks, that so many minutes and seconds had passed since they had left Geneva, or passed other places; and, after a while, he engaged to indicate to the crowd about him the passing of a quarter of an hour, or as many minutes and seconds as any one chose, and that during a conversation the most diversified with those standing by; and further, to indicate by the voice the moment when the hand passed over the quarter minutes, or half-minutes, or any other subdivision previously stipulated, during the whole course of the experiment. This he did without mistake, notwithstanding the exertions of those about him to distract his attention, and clapped his hands at the conclusion of the time fixed.

M. Chavannes then reverts to his own observations. The man said, "I have acquired by imitation, labour, and patience, an internal movement, which neither thoughts, nor labour, nor any thing, can stop; it is similar to that of a pendulum, which, at each motion of going and returning, gives me the space of three seconds, so that twenty of them make a minute, and these I add to others continually." The calculations by which he obtained subdivisions of the second were not clearly understood by M. Chavannes, but the man offered freely to give proof of his power. On trying him for a number of minutes, he shook his head at the time appointed, altered his voice at the quarter, half, and three-quarter minutes, and arrived accurately at the end of the period named. He seemed to assist himself in a slight degree by an application of mnemonics, and sometimes, in idea, applied religious names to his minutes up to the fifth, when he recommenced; this he carried through the hour, and then commenced again. On being told that the country people said he made use of his pulse as an indicator, he laughed

at the notion, and said it was far too irregular for any such purpose.

He admitted that his internal movement was not so sure and constant during the night; "nevertheless it is easy to comprehend," he said, "that, when I have not been too much fatigued in the evening, and my sleep is soft, if, after having awakened me without haste, you ask me what the hour is, I shall reflect a second or two, and my answer will not be ten minutes in error. The approach of day renews the movement if it has been stopped, or rectifies it, if it has been deranged, for the rest of the day." When asked how he could renew the movement when it had ceased, or was very indistinct, he said, "Sir, I am only a poor man; it is not a gift of Heaven; I obtained this faculty as the result of labours and calculations too long to be described; the experiment has been made at night many times, and I will make it for you when you please." M. Chavannes had not, however, the opportunity of making this experiment, but he felt quite convinced of the man's powers. He states that the man is deaf, and cannot hear, at present, the sound of his clock or watch; and further, that neither of these vibrate twenty times in a minute, which is always the number indicated by the motions of Chevalley when he wishes to illustrate his internal movement; and he is convinced, according to what he has seen, that *this man possesses a kind of internal movement, which indicates minutes and seconds with the utmost exactness.*

RAILWAYS.

(Continued from our last.)

It will be convenient, before we proceed farther, to give a short summary of the propositions already laid down respecting the motion of bodies on Railways, viz.—

1. The resistance to the motion of the body, arising from friction, is the same at all velocities; that is, the resistance is equal in equal times, whatever be the space passed over. This is the primary law established by the experiments of Vince and Coulomb.

2. It follows from this law, that a body impelled along a railway by any constant power, exceeding what is sufficient to overcome the resistance of friction (which is an uniform quantity), will have its motion continually accelerated in the ratio of the squares of the times. A body, for instance, so impelled, which travels one foot or one yard in the first second, will travel three feet or yards in the next second, five feet or yards in the third, seven in the fourth, and so on. Its motion, if not strictly conformable to this principle, will at least approximate to it.

3. It follows also from the same law, that if the power expended in overcoming the inertia of the moving body in the earlier part of the journey, is saved by an impulse given at the moment of starting, the body will proceed exactly as it would have done, had it arrived at the same degree of velocity by its own accelerating power—that is, it will not only maintain the high velocity thus communicated, but increase it. In other words, the same constant power which would maintain a velocity of two miles, would equally maintain a velocity of 20 miles an hour. It is to be remembered that we take no account here of the resistance of the air.

We are afraid that some practical men will be disposed to treat these propositions as matter of idle and fruitless speculation. We confess this does not at all abate our confidence in their truth. We know that no useful improvement has ever been introduced without a hard struggle with their ignorance and prejudices, which create a species of moral resistance more intractable than the *vis inertiæ* of matter to the mechanician.

The most sanguine speculation, in our opinion, is often less offensive and less wrong-headed than your thorough-paced practical man, who is generally an incorrigible dogmatic as to the nostrums, right or wrong, which his own narrow experience has taught him, and stubbornly incredulous as to every thing beyond them. We believe, however, it will not be difficult to reconcile the principle we have been laying down with the results of every day's experience, as some may suppose.

We see nothing, it may be said, of the constant acceleration alluded to in the motion of a waggon on a level railway or common road (to the latter of which the laws of friction are applicable as well as the former). But this is easily explained. The friction is a constant, and the horse's traction, a variable quality. Suppose that a force of 90 pounds would exactly balance the friction, and that the horse begins to draw with a power of 100 pounds, proceeding at two miles an hour, the accelerating force is then 10 pounds; the horse, if he

does not spare himself, will quicken his pace, perhaps, till he is travelling at the rate of three miles an hour. But though he exerts the same muscular energy now, he pulls only with a force of 81 pounds, while his friction requires 90. He will, therefore, gradually reduce his pace again to three miles an hour, at which rate, with the same expenditure of strength, he pulls with a force exactly equal to the friction, that is, 90 pounds. The horse may either adjust the effort to the resistance in this way, or he may save his strength by walking slow, and pulling with a smaller force.

Every body knows, that the rate of stage-coach travelling in this country has increased within the last twenty-five years, and this too before the roads were M'Adamized, and with much less injury to the horses than was anticipated. Supposing that a coach-horse could run 14 miles, unloaded, with the same muscular exertion which carries forward the stage-coach at eight or nine miles, then Professor Leslie's formula becomes $\frac{3}{4}(14-v)^2$. Each horse would, of course, draw with a force of 48 pounds at six miles, and of 27 pounds at eight miles an hour. But if the friction increased in the ratio of the velocity, the load upon each horse would increase from 48 to 60 pounds, when the speed increased from six to eight miles an hour; and as the horse, exerting the same strength, would only pull with a force of 27 pounds, he would thus have more than double work to do, which is plainly impossible. But admit that the friction is equal in equal times, then, since the time is diminished one-fourth by increasing the speed from six to eight miles an hour, the horses have actually one-fourth less to do; the load upon each is reduced from 48 pounds to 36. The fact, we believe, will be found strictly consistent with this hypothesis, and decidedly at variance with the other. However strange then it may sound to common observers, it is practically true, that a smaller absolute amount of force will drag a coach over the same space in three hours than in four and in one hour than in two.

Common roads, however, vary so much in the nature of their surface and their inclination, that the results they afford cannot easily be subjected to the calculations of the mathematician. With railways the case is otherwise; and we shall now show how the effects of a certain force of traction upon a horizontal road of this description is to be computed. As the friction of a given body is a fixed and constant quantity, the power employed in impelling the machine may conveniently be divided into two portions—one to balance the retarding effect of the friction, the other to urge it forward, which, of course, constitutes the accelerating force. Let us then suppose that a force of traction equal to 200 pounds is applied on a railway to a waggon or a machine weighing, with its its load, 30,000 pounds. Of this force let us suppose 100 pounds to balance the friction; of course, the remaining 100 pounds is applied to the acceleration of the machine. Now the accelerating force of 100 pounds is equal to the 300th part of the body to be moved. The machine will therefore advance through a 300th part of 16 feet in the first second; through three times this fractional space in the next second; five times the same space in the third second, &c. By pursuing this calculation, we find that the machine will travel $8\frac{1}{4}$ miles in 15 minutes, 33 miles in half an hour, and 130 in an hour. Such would be the result in space absolutely void; but a degree of speed approaching to this is rendered utterly impossible by the resistance of the atmosphere, which retards the motion from its commencement, and ultimately renders it uniform, however great may be the moving power employed. It is to be observed, that with an accelerating force of double the one assumed (or 200 pounds), the space gone over in the same time would be double; with a treble force (300 pounds) it would be treble, and so on.

We shall now estimate the retarding effect produced by the resistance of the air. During high winds this resistance is so considerable, that means should be taken to lessen its amount; first, by making the vehicle long and narrow, rather than broad and short; and, secondly, by giving the front a round or hemispherical form. Let us suppose, then, that there are two steam vehicles, each weighing, with its engine, fuel, and load, 15 tons. The one, a steam-waggon for conveying goods, is six feet high and five feet wide, and has, of course, a front of 30 square feet, which, in reference to the pressure of the air, is reduced to 15, by giving it a rounded form; the other, a steam-coach for carrying passengers, is eight feet high and eight wide, or seven high and nine wide, presenting a front of 60 square feet, but reduced to 30 by its rounded form. Now, still air is found by experiment to press with a force of 16 grains upon a body presenting a front of one foot square, and moving at the rate of one foot in a second, and the pressure increases as the square of the velocity. Hence our steam-coach, when moving at four miles an hour in a still atmosphere, would encounter a resistance from the pressure of the air of $2\frac{1}{4}$ pounds; at eight miles an hour the resistance would be nine pounds; at 12 miles, 20 pounds; at 16 miles, 36 pounds; at 20 miles, 57 pounds. The steam-waggon, presenting only half the surface in front, would experience only half the resistance. Let us assume,

according to what we have already stated, that a power of 100 pounds would just put the steam-coach in motion; then, if we allow an additional power of 33 pounds for acceleration, making 133 pounds altogether, we find that, if the air did not oppose its progress, it would move over 43 miles in one hour. But since it is propelled only by a force of 33 pounds, as soon as the resistance of the air pressed it back with a force of 33 pounds, the acceleration would cease, and the motion become uniform. Now this would take place within 15 or 20 minutes, and when the velocity had risen to 14 or 15 miles an hour. With the steam-waggon, presenting only half the front, the velocity would become uniform, at 22 miles an hour. Hence we see, that if we had always a perfect calm in the atmosphere, we could impel 15 tons along a railway with a velocity of 15 or 22 miles an hour (according to the extent of surface the vehicle presented), by a force of 133 pounds.—We may now compare the resistance of a railway with that of a canal or arm of the sea in a calm atmosphere.

According to the table formerly given, the force required to propel a vessel weighing, with her load, 15 tons through water at different velocities, would be as follows:—

At	4 miles per hour..	133 pounds.
	6	300
	8	533
	12	1200
	16	2133
	20	3325

On a railway, we have merely to add the power required to overcome the friction (100 pounds), a few pounds more to balance the resistance of the atmosphere at the velocity proposed. For the steam-coach, with 30 feet of front, it would be as follows:—

At	4 miles per hour..	102 pounds.
	6	105
	8	109
	12	120
	16	137
	20	158

We see from this table the astonishing superiority of the railway over the canal, for all velocities above four miles an hour. Nearly three times as much power would be required to move an equal mass at six miles an hour on a canal as on a railway; five times as much power would be required at eight miles an hour, 10 times as much at 12 miles, 15 times as much at 16 miles, and 21 times as much at 20 miles an hour. It is evident, also, that an addition of power too trifling to add any thing material to the weight of the vehicle, would raise the terminal or uniform velocity from four miles an hour to 20; and that, speaking practically, it would cost no more to command a velocity of 20 miles an hour on a railway than a velocity of one. Except for the chances of injury to the railway or the vehicle, there would not be the smallest reason for conveying goods, even of the coarsest kinds, at four miles, rather than at 20 miles an hour!

But a perfect calm in the atmosphere is very rare, and vehicles intended for daily and constant use must be prepared to contend with the strongest winds. The power must therefore be increased to such an extent as to enable the vehicle to travel at its wonted pace in all weathers. Now, according to Mr. Smeaton, a "hard gale" is found to sweep along the surface of the earth at the rate of from 40 to 50 miles an hour. This velocity, which would be increased to 60 or 70 by that of the steam-coach when travelling at 20 miles an hour, would produce a resistance of 600 pounds upon the 30 feet of front of the steam-coach, or 300 pounds upon the front of the steam-waggon. With a speed of eight miles an hour, the coach and waggon would encounter a resistance about one-half less. The vehicles, however, should not be constructed entirely with a view to extreme cases; and, except for the conveyance of mails and some similar purposes, an average velocity of 20 miles an hour, for vehicles of the weight and description mentioned, would be secured by a power varying from 200 to 500 pounds; that is, from one-fifth to one-tenth of the power required to produce the same effect on water. We see, however, that the resistance of the air, which, in vulgar apprehension, passes for nothing, comes to be the greatest impediment to the motion of the vehicles, and may in some cases absorb five parts in six of the whole power. Let it be remembered, at the same time, that this aerial resistance rises into consequence solely because the high perfection of the machinery, the vehicle, and the road, almost annihilates every other. The atmosphere equally opposes the progress of the stage-coach, the track-boat, and the steam-boat; but the motion of these vehicles is comparatively so slow, and the power of impulsion required to overcome the other impediments to their progress is so great, that the resistance of the air is disregarded.

In discussing this subject so much in detail, we have perhaps exceeded what is suitable to our limits; but it is singular that, so far as we know, the application of the laws of friction to the motion of carriages on railways has scarcely ever been investigated. Yet the subject is of vast importance, and the results extraordinary. Among all the new projects and inventions with which

this age teems, there certainly is not one which opens up such a boundless prospect of improvement, as the general introduction of railways for the purpose of commercial communication. We have spoken of vehicles travelling at 20 miles an hour; but we see no reason for thinking that, in the progress of improvement, a much higher velocity may not be found practicable. Tiberius travelled 200 miles in two days, and this was reckoned an extraordinary effort; but in our times, a shopkeeper or mechanic, on the most ordinary occasion, travels twice as fast as the Roman Emperor; and 20 years hence, he may probably travel with a speed that would leave the fleetest courser behind. Such a new power of locomotion cannot be introduced without effecting a vast change in the state of society. With so great a facility and celerity of communication, the provincial towns of an extensive empire would become so many suburbs of the metropolis; or rather the effect would be similar to that of collecting the whole inhabitants of a country into one city. Commodities, inventions, discoveries, opinions, feelings, would circulate with a rapidity hitherto unknown; and, above all, the personal intercourse of man with man would be prodigiously increased. Were the ugly despotisms that retard civilization on the Continent annihilated, Europe might be made, as it were, one family, by such a system of internal communication.

(*To be continued.*)

EVANS'S TABLES OF DISCOUNT AND PROFIT.

Sir,—In your Magazine, No. 63, page 106, your Birmingham Correspondent, who signs himself "A Constant Reader," has made the world acquainted with what he appears to consider to be a great discovery. I have no reluctance in confessing that I do not comprehend the observation. "For instance, a shopkeeper buys an article for 1*l.* and sells it for 1*l.* 1*s.* *falsely* supposing that he gains 5 per cent., whereas he ought to get one shilling *in* 20*s.*, or 5*l.* *in* and not *on* 100*l.*" Now, according to my plain understanding, whether a man puts out 100*l.* at 5 per cent. interest, or employs the same sum in trade, and at the end of the same period finds that he is worth 105*l.*, I conceive that he makes 5 per cent. upon his investment, or, in other words, that he increases his capital just one-twentieth part, which, as my Walkingame informs me, is making an increase or profit of 5 per cent.

If the position which your Correspondent has discovered be received, we shall want some new system of arithmetic, and poor old Cocker and all his descendants may be consigned to the shelf, or be made into tobacco-pipe lights.

The observation above quoted is not the only one that puzzles me in the Birmingham article; that which defies doubt itself is a very long passage beginning with, "The industrious mechanic," and ending with, "one shilling out of sixteen." I have endeavoured to unravel it, but without effect, unless my having made up my mind to suppose that some great truth is intended to be conveyed, which the writer did not think it prudent to state in commonly intelligible terms, may be said to be the effect of my repeated trials to understand it.

I ought to observe that you have afforded an antidote to the error of your "Constant Reader," in the quotation which you have given from Mr. Evans's book, where he observes that, "For instance, 5 per cent. added to 100*l.* increases it to 105*l.*" But as this quotation may not meet the eye of a hasty reader, I take the liberty to request the insertion of these remarks; and I beg to be permitted to say that your compliance will induce me to forward, for your Magazine, a few rules applicable to all cases where profit and discount can be the subject of consideration.

I am, Sir,
Your obedient servant,
M. W.

Fenchurch-street.

INQUIRY.

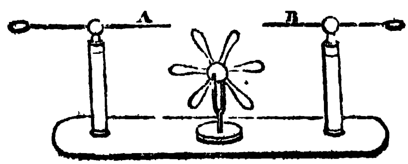
NO. 88.—DYEING AND VARNISHING.

Sir,—Will any of your readers oblige me by a receipt for the best mode of dyeing Ivory Scarlet; also for putting a high polish, without a great thickness of varnish, upon hard wood?

MECHANICAL EFFECT OF ELECTRICITY.

The Mechanical Effects of Electricity are exhibited in its power of impelling and dispersing light bodies; of perforating, expanding, compressing, tearing, and breaking to pieces, all conducting substances through which it is sufficiently powerful to force its passage.

If a light wheel, having its vanes made of card paper, be made to turn freely upon a centre, it will be put in motion when it is presented to an electrified point. The wheel will always move from the electrified point, whether its electricity is positive or negative. In this experiment the current seems to be produced by the recession of the similarly electrified air in contact with the point, and therefore the circumstance of the wheel turning in the same direction when the electricity is negative, cannot, as Mr. Singer has remarked, be considered as any proof of the existence of a double current of the electric fluid. As an illustration take the following experiment:—



Place upon an insulating stem a light wheel of card paper, properly suspended upon pivots, as represented in our Plate, and introduce it between the pointed wires (AB) of the universal discharger, placed exactly opposite to each other, and at the distance of little more than an inch from the upper vanes. Then having connected the wire A with the positive conductor, and the wire B with the negative conductor, of an electrical machine, the little wheel will revolve in the direction AB; and if the wire B is connected with the positive end, and A with the negative end, the motion of the wheel will be from B to A. The transmission of a small charge through the wires, by an insulated jar, will produce the same effect.

The preceding experiment, imagined by Mr. Singer, is considered by him as a proof that there is only one electric fluid, and that it passes from the positive to the negative wire; for, if there were two electric fluids, he concludes, "that the wheel being equally acted upon by each, will obey neither, and remain stationary."—*Chemist.*

INTERESTS OF SCIENCE *versus* POPULAR PREJUDICES.

SIR,—Allow me to express my surprise and disgust at the sentiment expressed by your Correspondent, calling himself "A Medical Reader," in your 69th Number, respecting *resurrection-men.* He says, speaking of the employment of destructive powder deposited in coffins for the purpose of blowing resurrection-men up—"*that it would be well to blow up the whole of them!*" than which a more inhuman and barbarous sentiment could not, in my judgment, have been uttered; for is it not evident that the interests of science, in the present state of our laws, render the practice of body-stealing absolutely necessary, unless this "Medical Reader" is prepared to prove that ignorance of the principles of

anatomy and surgery is an evil of less magnitude to the interests of the community than the tolerating of the practice in question? This, I suspect, he will never be able to do to the satisfaction of any one unprejudiced and intelligent man in the country; and therefore the only possible effects that can be produced by a sentiment so abominable as that which he has ventured to express, must be to foster the prejudices of ignorance, and to inflame the vulgar mind still more against a class of individuals, who, after all, are merely the machines or instruments of others. This writer, to be just, and effectually to accomplish his object, should begin with the old sinners—the employers of resurrection-men, by "blowing-up" the Clines, the Coopers, the Lawrences, the Abernethys, and all the rest of the masters and teachers of anatomy and surgery, together with the schools and colleges to which they belong, and let us revert back to a state of profound and contented ignorance on the noble sciences in question. Without this, it is evident that, if all the resurrection-men in existence were "blown up" to-day, your "Medical Reader" would have a fresh set to "blow up" to-morrow. Then, as to this state of ignorance, let us suppose this "Medical Reader" to require, in his own person, the performance of some critical operation in surgery, such, for instance, as the amputation of a limb at the hip-joint, the operation for strangulated hernia, or cutting for the stone or fistula, or even the comparatively simple operation of introducing the catheter into the bladder in the distressing case of a suppression of urine;* what would then be his feelings respecting the ignorance and incapacity of the professors of the surgical art, which his sentiment, if carried into complete effect, is alone calculated to produce? The skilful performance of these delicate and difficult operations can only be attained by practice, I presume, in the first instance, upon the dead subject, and by an unwearied application to the study of that most complex and admirable piece of mechanism made by the hand of the Deity, in its quiescent state, before their beneficial results can be made practically applicable to the living body.

Let not this "Medical Reader" infer, that I would willingly consign the bodies of my friends and dear relations to the dissecting-room. No, Sir; this I would undoubtedly prevent by every reasonable precaution in my power: but I would not protect the dead by the employment of any murderous means of destruction directed against the living, in a case where, after all that can be said on the subject, the injury to the dead is merely ideal, while the good which results from it to the living is manifest and indisputable. For my own part, I must confess, that the few occasions in my life on which I have had an opportunity of visiting a dissecting-room, much of the disgust and horror which the scene is calculated to produce, was subdued and overpowered by a stronger feeling of commiseration at the sight of so many young men poring over the putrid objects of their study, at the imminent risk of imbibing disease at every pore, and of inhaling the pestilence of death at every breath they drew. At all events, so long as the laws remain what they are respecting body-stealing, and so long as this is the only way left open to procure subjects for the improvement of the surgical art, we might at least expect that every friend of science, and especially that every friend of medical science, would look with some degree of lenity, and express himself with some degree of moderation, upon the practice.

I cannot, Sir, truly designate myself a "Medical Reader;" still less,

* This latter is a case on which I speak feelingly, having, some years since, in a dangerous illness, had my water drawn off, for eight successive days and nights, by that most eminent practitioner, Mr. Thomas Blizard. The gratitude and regard which I felt towards him for his skill and kindness on that occasion, are as fresh in my recollection, at this distance of time, as if the cause which originated them had only been the occurrence of yesterday. In short, to his attention and skill, I am indebted for my life.

I lament to say, can I call myself anatomist or surgeon; and therefore, in all these respects, I am no more interested in the question at issue than the meanest member of the community. What I presume to call myself, and what I flatter myself I really am, is, that I am

A LOVER OF JUSTICE.

December 25th, 1824.

SIR,—Although I have taken in your publication from its commencement, I should not have trespassed on your time, had I not seen, in last week's Magazine, some observations by your Correspondents T. H. B. and T. M. B. relative to the enormity of disturbing the dead in their last resting-places. Perhaps these Gentlemen are not aware, that it is impossible for any man to exercise the profession of medicine without an intimate knowlege of the parts of the human frame, and the functions of all the vital organs, which cannot be acquired in any other way than by actual dissection; the toil of which, combined with the noisome stench attending it, ought, I think, to shield us from the scoffings of those persons who do not know how absolutely necessary a perfect acquaintance with anatomy is to the medical student. That great luminary of our profession, the late John Hunter, used to observe, that for a man to practise surgery without knowing anatomy, was like a child in a powder-magazine with a lighted match in its hand. Your Correspondent very *facetiously* says, "Why do not the surgeons bequeath their own bodies for dissection?" to which I beg leave to answer, that if every medical man in the United Kingdoms was to surrender up his carcase after death, still would there be not one-fortieth part enough to satisfy the remainder of the living fraternity. On an average, there is in London at this time eight or nine hundred medical students, every one of which number ought carefully to dissect two or three bodies before entering upon his duty as a surgeon. As the ignorance of this part of our science is often fatal to the patient, so the thorough knowledge of it is certainly to be considered a point of no small importance.

I augur, from your well-known impartiality, that you will insert this answer to T. M. B., and by so doing you will oblige,

MEDICUS.

SUPERIOR PROCESS OF WASHING-OVER EMERY.

The genuine Emery-stone is brought to us from Naxos, one of the islands in the Greek Archipelago. It is found in hard, compact, stony masses, of a bluish purple colour, interspersed with pyrites. These lumps of emery are used in their native state, in Sweden, to shape porphyry into slabs, mortars, &c.; being held firmly against the masses of porphyry, whilst the latter are turned in large lathes, moved by the power of water. They are also used in this country by the glass-cutters to turn their cast-iron laps into shape; and the emery made from them is greatly preferable to any other in its effects upon the articles to be cut or abraded by it, owing to its great hardness. This valuable property of hardness, however, has increased the difficulty of manufacturing emery from it; and, accordingly, substitutes have been found for it, which fall vastly short, indeed, in this very desirable quality.

Mr. John Isaac Hawkins has lately introduced a mode of preparing emery for nice purposes, which appears to be of a very superior description. He was led to it by finding that the emery commonly sold was totally inefficient for the purpose he had in view, namely, grinding two flat surfaces of hard cast-steel accurately; as the workman found that only a few of the coarser parts of the emery scratched the surfaces of the steel plates, and kept the remainder of it from acting at all; and, in fact, that his labour was in vain. On this, Mr. Hawkins thought of applying a process which he had seen used in Liverpool for washing-over *diamond-dust*, to be used in watch-jewelling, to

emery; and in order to be sure that his emery should be of a good quality, he took the precaution of purchasing, at an eminent emery-maker's, a quantity of those small lumps or grains of emery which had longest withstood the action of the cast-iron runners and bed, and thus ensured the *hardness* of the emery. These lumps he caused to be reduced to powder in a mortar of cast-iron, and then sifted the powder into different varieties, by passing it through a series of wire-sieves; the first sieve having 20 squares in the inch, the next 30, and so on to 80: and thus he obtained eight different degrees of emery.

He next treated the emery which had passed through the finest sieve, by washing it over in the same manner as the diamond-dust was treated, namely, in *oil, which held it suspended for a much longer time than the water*, which is usually employed for this process: and in this way he obtained a series of emery, which had floated one minute, five minutes, ten minutes, fifteen minutes, twenty minutes, forty minutes, and eighty minutes; amongst which he found every variety necessary for his purpose, and deposited them in separate boxes for use, numbered according to the minutes they had floated; and he could thus, at any subsequent period, be certain of producing other emeries of the very same description.

We need hardly add, that, by using these latter emeries in succession, beginning with the coarsest, he not only very soon accomplished the object he had in view, but has also since employed them in grinding three flat circular plates of cast iron to perfectly plane surfaces, correcting, as usual, the tendency in either to become concave or convex, by means of the third plate.

Emery hard enough to cut Rubies.

Mr. Hawkins, pursuing the same practice of selecting those grains of emery which resisted longest the action of the pestle and mortar, eventually obtained some *so hard* as to be capable of *cutting a ruby*, when employed in a similar manner to *diamond-dust* in watch-jewelling. He has also found it desirable sometimes to separate his emery, by washing it over in one, two, three, four, and five minutes, and so on, as before mentioned.

Sapphires found in the Greek Emery Stone.

The Editor of the *Technical Repository* states, that he has lately treated some portions of the Greek emery-stone by grinding them to powder between two flat and hard steel surfaces, and washing off the lighter parts in oil: he then placed a small portion of what had subsided, after floating only half a minute, upon a slip of glass, and examined it in the microscope, under a highly-magnifying power, and found that many parts of it had entirely withstood the grinding action (except only their being separated from the mass), and were, in fact, *perfectly crystallized sapphires!*

NEW SET OF CALCULATING RODS.

At a recent Meeting of the Astronomical Society of London, there was read a decription, drawn up by Dr. Gregory, of a Box of Rods, named the Rhabdological Abacus, which had been presented to the Society by the family of the late Henry Goodwin, Esq. of Blackheath. It appears that these rods were invented by Mr. Goodwin, for the purpose of facilitating the multiplication of long numbers of frequent occurrence. They were probably suggested by Napier's rods, and are, for the purposes which the inventor had in view, a great improvement upon them. The rods, which are square prisms, contain, on each side successively, the proposed number in a multiplicand, and its several multiples, up to nine times; and these, in the several series of rods, are repeated sufficiently often to serve for as extensive multiplications as are ever likely to occur. Thus, if the four faces of one rod contain, respectively, once, twice, three times, and four times, a proposed multiplicand, another rod will exhibit, in

like manner, twice, three times, four, and five times the same; a third rod, three, four, five, and six times the same; a fourth rod, four, five, six, and seven times the same multiplicand; and so on to nine, and, in several cases, more rods.

The numbers are arranged uniformly upon equal and equidistant compartments, while at a small constant distance to the left of each product stands the number 2, 3, 4, 5, &c. which it represents. Hence, in performing a multiplication, the operator has only to select from the several faces of the rods the distinct products which belong to the respective digits in the multiplier—to place them in due order above each other, —to add them up while they so stand, and write down their sum, which is evidently the entire product required, and obtained without the labour of multiplying for each separate product, and even of writing those products down. For still greater convenience the rods may be arranged upon a board, with two parallel projections placed aslant, at such an angle as of necessity produces the right arrangement. There are blank rods to place on those lines which accord with a cypher in the multiplier, and the arrangement may easily be carried on from the bottom product upwards, by means of the indicating digits.

A QUESTION IN OPTICS.

SIR,—As a subject likely to excite some little consideration, as well as research, amongst your numerous readers, and for the purpose of deciding a controversy which has arisen between a few friends, not very capable of experimental determination, I make no apology for requesting the insertion of the following question in your Magazine.

What is the greatest distance at which the human sight, under every most favourable circumstance of light and situation, can discern the hands and figures of an ordinary turret-clock (say four feet in diameter), so as to tell the hour?

It is conjectured, that the evening, when the sun's rays may be almost reflected horizontally from the face of the clock to the spectator's eye, would be the most favourable time of the day, and that across water would be the most advantageous situation; but inasmuch as the extent of diminution of the angle under which the hands and figures are observed, by the increased distance, must be limited to the size laid down by writers on optics, as capable of exciting a sufficient image upon the retina of the eye, there must be an extent beyond which every aid, save that of a telescope, is unavailing.

If some of your inquiring readers will assist our discussion of the question, by an investigation of the foregoing principles, they will oblige their co-operator, and

Your constant Reader,

S.

SIR HUMPHRY DAVY'S COPPER SHEATHING.

His Majesty's ship Samarang, of 28 guns, Captain David Dunn, arrived on the 25th of December at Portsmouth, from Halifax, after a tempestuous passage of nineteen days. "We understand (says a Portsmouth Paper) the return of the Samarang to England, after being so few months on the North American station, is occasioned by a discovery of the complete failure of Sir Humphry Davy's experiments to preserve ships' coppers from decay. The Samarang was fitted out at this port under that eminent chemist's direction, with the zinc preservers attached to the sheathing metal, by means of which, producing galvanic action, it was expected the copper would be preserved from corrosion; but it is proved, that though the oxidation of the metal is prevented by the defensive action of the iron, the animalculæ which this oxidation used to destroy now prey in such security upon the vessel, that the bottom of the Samarang is covered with worms, barnacles, and sea-weeds, to a degree which prevents her from being steered with necessary safety. She is, therefore, returned to England to be docked and recoppered."

ZINC PLATES FOR ENGRAVING.

In Germany, artists have begun to substitute zinc plates instead of copper plates, and also instead of stone, for engravings. The artist draws on the zinc as on stone, and the expense of engraving is thus saved. A large work, being a collection of monuments of architecture, from zinc plates, has already appeared at Darmstadt, and is highly spoken of. The process is said to unite the economy of lithography with the clearness of copper engraving.

TO MEASURE THE CONTENTS OF PIPES.

Square the diameter of the pipe in inches, and the product will be the number of lbs. of water, avoirdupois, contained in every yard's length of the pipe. If the last figure of this product be cut off or considered as a decimal, the remaining figures will give the number of ale gallons in a yard's length of the pipe; and if the product consist only of one figure, this figure will be tenths of an ale gallon. The number of ale gallons, divided by 282, will give the number of cubic inches in every three feet of the pipe, and the contents of a pipe of greater or less length may be found by proportion.

PRESSURE AND RAREFACTION OF THE AIR.

The pressure of the air, and its rarefaction by heat, are excellently illustrated by the following simple experiment:—Take hold of a wine glass with your right hand, and with your left put into it a small piece of burning paper. When the paper has burned for a few seconds, strike the mouth of the glass against the palm of your left hand, and it will remain firmly fixed to it for a considerable time. The cause of this is, that the internal air is so rarefied by the burning paper, that the pressure upon the inside of the glass is greatly diminished. The equilibrium, therefore, of the pressures upon the outside and inside of the glass being destroyed, the glass must adhere to the hand till that equilibrium is restored.

MATHEMATICAL HABITS.

Joseph Sauveur, the eminent French mathematician, was twice married: the first time he took a very singular precaution—he would not meet the lady till he had been with a notary to have the conditions, which he intended to insist on, reduced into writing, for fear the sight of her should not leave him sufficiently master of himself. This, says Dr. Hutton, was acting very wisely, and like a true mathematician, who always proceeds by rule and line, and makes his calculations when his head is cool.

SQUARING THE CIRCLE.

Sir,—After so much has appeared in your valuable Journal respecting "Squaring the Circle," I feel that some apology is due for trespassing on your readers with a few further observations on the subject.

Several of your intelligent Correspondents have sufficiently demonstrated, that a method of squaring the circle geometrically still is, and probably must ever remain, a desideratum in mathematics. But I have not observed that any one has attempted to show how nearly this may be effected mechanically; and, therefore, the information, which it is the purpose of this letter to convey, may possibly be new, as well as useful, to some of your readers. It is hardly necessary to premise, that the object is to construct a square, the area of which shall be equal to the area of a given circle, and the length of the side of which shall be expressed in parts of the diameter, or of the radius of that circle. The nearest whole numbers by which this can be effected are, probably, 8 and 9; that is, if the diameter of the given circle be divided into nine parts, the side of the square which shall nearly equal it in area, must be eight of those parts. This will rather exceed the truth; and it is impossible to do it exactly, although the error may be reduced to a less quantity than any

that can be assigned. For instance, a still closer approximation may be derived from dividing the diameter of the circle into 360 parts; then call the side of the square equal 319.041659, &c. of those parts, nearly. The square of this number will be rather less than the area of the circle, and the square of 319.041867 will exceed it; but these numbers do not differ till we come to the ten-thousandth place of the decimals, and then only by 2; therefore the first number is within 2-10,000th parts of the truth; and it may be seen by inspection, that the ratio of the numbers to each other is nearly as 8 to 9.

It is evident that there are no limits to this approximation; but the above will probably be found sufficiently near to the truth for all mechanical purposes.

N.

MANUFACTORY OF ORGANZINE.

SIR,—I have heard a good deal lately of the improvements which Mr. Badnall, jun. of Leek, Staffordshire, has made in the machinery for the manufacture of Organzine, Sewing Silks, &c. Being desirous of gaining information respecting these improvements, and thinking that, if they *are really improvements,* they cannot be made too public, I have taken the liberty of troubling you, as, from the great name and extensive circulation of your Magazine, it appears to be the best medium for such inquiries. I should conceive that the patentee can have no objection to reply to a few queries, as a full answer to them cannot but be generally useful.

It is said that by an union of operations this machine will, in comparison with the present method, effect a saving of *thirty per cent.* Is this *true?* and if true, *how is such very great and important saving to be effected?* Is the silk so manufactured *equal* in quality to that which is made by the present machinery? I particularly allude to the sewing silks, as those which have hitherto been made upon the common wheels have been always considered very good.

The amazing advantages promised by this new method are certainly worthy of attention, as they must (if *real*) enable this country to enter into a *successful* competition with all others. If the patentee should choose to notice this inquiry, probably he would have no objection to give all the information in his power as to terms, &c. and who is his agent.

I am, Sir,
Your obedient servant,
A CONSTANT READER.

P. S. Are these improvements applicable to the manufacture of silk for lace and tram?

SINGULAR OPTICAL DECEPTION.

When the wheel of a carriage in motion is attentively viewed through vertical bars, such as the rails of a palisade or the laths of a Venetian blind, the spokes appear to bend downwards, and more or less so as they are situated farther from or nearer to the spoke which happens to be vertical, and which always appears to be perfectly straight. Dr. Mark Roget, in a paper which he has addressed on the subject to the Royal Society, explains this curious phenomenon by supposing that the impression made on the retina by a pencil of rays, when sufficiently vivid, continues for some time after the cause has ceased. He thinks it even possible to estimate the actual duration of any impression on that organ, from the apparent velocity of the spokes.

NEW PATENTS.

Louis Lambert, of No. 10, Rue-de-la-Gout, Paris, France, but now residing at No. 29, Cannon-street, London, Gentleman; for certain improvements in the material and manufacture of paper. Dated Nov. 23, 1824.

John Osbaldeston, of Shire Brow, Blackburn, Lancashire, calico-weaver; for an improved method of making healds to be made in the weaving of cotton, silk, woollen, and other cloths. Dated Nov. 29, 1824.

Stephen Wilson, of Streatham, Surrey, Esq.; for a new manufacture of stuffs,

with transparent and coloured figures, which he calls Diaphane Stuffs. Communicated to him by a certain foreigner residing abroad. Dated Nov. 25, 1824.

William Shelton Burnett, of New London-street, London, merchant; for certain improvements in ships' tackle. Dated Nov. 25, 1824.

Thomas Hancock, of Goswell-mews, Goswell-street, Middlesex, patent cock-manufacturer; for a method of making or manufacturing an article which may be applied to various other useful purposes. Dated Nov. 29, 1824.

William Furnival, of Anderton, Cheshire, salt-manufacturer; for certain improvements in the manufacture of salt. Dated Dec. 4, 1824.

William Weston Young, of Newton-cottage, Glamorganshire, engineer; for certain improvements in manufacturing salt; part of which improvements are applicable to other useful purposes. Dated Dec. 4, 1824.

John Hillary Suwerkrop, of Vine-street, Minories, London, merchant; for an apparatus or machine, which he denominates a Thermophore, or a portable mineral or river water-bath and linen-warmer; and also for other apparatus or machines connected therewith for filtering and heating water. Communicated to him by a certain foreigner residing abroad. Dec. 4, 1824.

George Wycherley, of Whitchurch, Shropshire, saddler; for certain new and improved methods of making and constructing saddles and side-saddles. Dated Dec. 4, 1824.

Robert Dickenson, of Park-street, Southwark, Surrey; for an improved air-chamber for various purposes. Dated Dec. 7, 1824.

John Thompson, of Pembroke-place, Pimlico, and of London Steel-works, Thames-bank, Chelsea; for an improved mode of making refined, or what is commonly called cast-steel. Dated Dec. 9, 1824.

Robert Bowman, of Aberdeen, Scotland, chain-cable maker; for an improved apparatus for stopping, releasing, and regulating chain and other cables of vessels, which he denominates elastic stoppers. Dated Dec. 9, 1824.

William Moult, of Lambeth, Surrey, engineer; for an improvement or improvements in water-working wheels. Dated Dec. 9, 1824.

Sir William Congreve, of Cecil-street, Strand, Middlesex, Baronet; for an improved gas-meter. Dated Dec. 14, 1824.

Samson Davis, of Upper East Smithfield, Middlesex, gun-lock-maker; for an improvement or improvements applicable to guns and other fire-arms. Dated Dec. 18, 1824.

David Gordon, of Basinghall-street, London, Esq.; for certain improvements in the construction of carriages or other machines to be moved or propelled by mechanical means. Dated Dec. 18, 1824.

Samuel Roberts, of Park-grange, near Sheffield, Yorkshire, silver-plater; for an improvement in the manufacture of plated goods of various descriptions. Dated Dec. 18, 1824.

Pierre Jean Baptisti Victor Gosset, of Clerkenwell-green, Middlesex; for certain improvements in the construction of looms or machinery for weaving various sorts of cloths or fabrics. Dated Dec. 18, 1824.

Joseph Gardner, smith, and John Herbert, carpenter, both of Stanley Saint Leonard's, Gloucestershire; for certain improvements on machines for shearing or cropping woollen cloths. Dated Dec. 18, 1824.

William Francis Snowden, of Oxford-street, Saint George Hanover-square, Middlesex, mechanist; for a wheel-way, and its carriage or carriages, for the conveyance of passengers, merchandize, and other things, along roads, rail and other ways, either on a level or inclined plane, and applicable to other purposes. Dated Dec. 18, 1824.

John Weiss, of the Strand, Middlesex, surgical instrument-maker and cutler; for certain improvements on exhausting, injecting, or condensing pumps or syringes, and on the apparatus connected therewith; and which said improvements are applicable to various useful purposes. Dated Dec. 18, 1824.

CORRESPONDENCE.

Mr. Bannatyne's letter in our next.

R. H. would see from last Number that he had been anticipated in his explanation.

Communications received from—G. W. —Mr. Pasley—M. J.—A Staffordshire Farmer and Land-Drainer—Anti-Colonade—Major—J. G. H.—W. S.—Philotechnus—Mr. Burridge—Joseph Hall —Stultus—A. F. M.—Inquirer—A White-smith—D. T.—A Discharged Dock-yard Man—P. Nimmo.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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" He who does his best, however little, is always to be distinguished from him who does nothing.'
—*Dr. Johnson.*

IMPROVED POTATO-WASHER.

Fig. 1

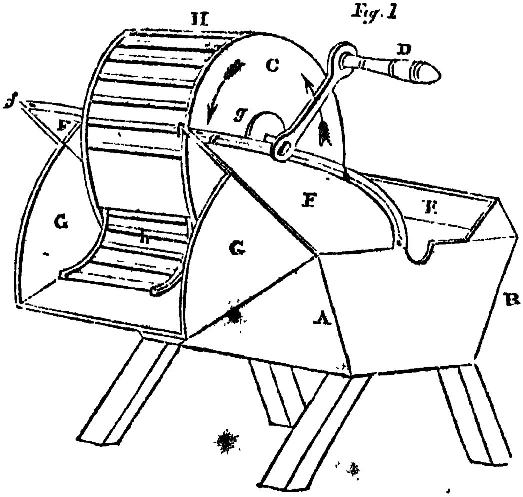
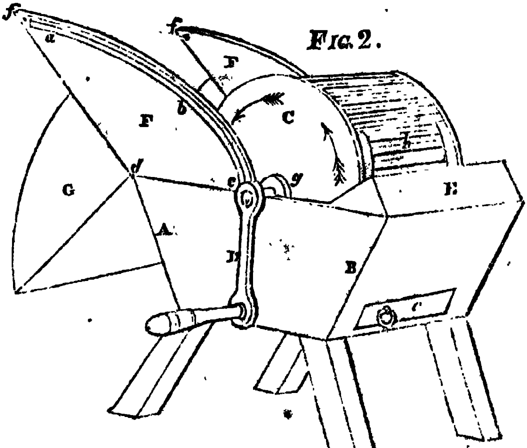
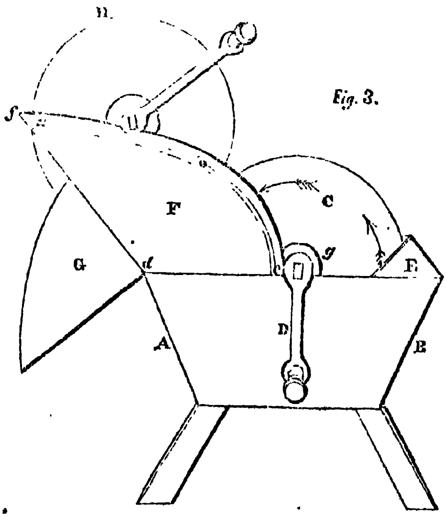


FIG. 2.





IMPROVED POTATO-WASHER.

SIR,—In Number 23, for Jan. 31, of your highly useful and interesting publication, you have described a Machine for washing Potatoes. A multiplicity of other engagements has heretofore prevented me from introducing another to your notice, which I consider to possess great advantages over that; as, in the first, two persons are required to lift the potatoes from the trough, while in mine they are discharged by one person only, with very little exertion.

I send you three illustrative Drawings, namely, a back and front perspective, and a profile view. The letters refer to the same parts in each.

Description.

AB is a wooden trough, on four strong legs, of which I shall call A the front, and B the back.

C, a hollow cylinder, consisting of two circular wooden ends, which are connected together at their circumference by rails or spars about one inch square, and about the same distance apart. Eight or ten of these rails are framed together to form a door, *h*, which is made fast by two bolts sunk flush in the first rail; these bolts shoot into the two circular ends. This cylinder is fixed on a strong wooden axis, about two inches diameter, which passes through the two ends and the whole length of it, and on which it revolves, being turned by the winch, D.

E is a hood or cap, to prevent the water in the trough (which should be nearly full) from being driven over the end by the cylinder when in motion.

FF are two upright arms, wings, or brackets, springing from the sides of the trough, close to the hollow in which the axis works. As these answer the purpose of the jib of a crane, they must be carried as far forward as to allow the cylinder to clear the front edge of the trough. The edges of these wings, from *c* to *b*, must rise very bold, nearly a segment of a circle, of which *dc* must be the radius; and from *a* to *b* they should form an inclined plane.

abc Is a ledge projecting a little from the outside of each wing, and running in a direction parallel with the edge of it, only a little below the edge. These ledges must each have a groove or hollow to receive the cord or line, and to keep it in its proper direction.

G is a spout or shoot, to direct the potatoes into a basket or other receptacle, when they are discharged from the cylinder. In my potato-washer this spout turns on centres at *d*, so as to shut in between the wings FF, and occupy less room when the machine is not in use.

e, A long wooden plug, bevelled inwards at the edges, with a strong iron ring. By this the water is discharged with a sudden impetus, so as to carry away the dirt with it.

At the extreme points, *ff*, of the

wings, FF, are fastened two small but strong cords of equal length, made of good green hemp, and formed into loops at the other extremity. These are long enough to reach along the ledges, *abc*, to the axis of the cylinder, in each end of which is a small strong wire hook, sunk in a hollow, so as to lie flush, and pointing toward the front of the trough, *i. e.* in the direction of the motion.

g Is a collar or broad shoulder round the axis, and fastened to the ends of the cylinder, to keep it parallel to the wings and to the sides of the trough.

The cylinder of my machine is about 20 inches in diameter, and 19 inches long. This contains a bushel of potatoes. There should be just room left for the potatoes to move a little.

After turning the cylinder in the trough till the potatoes are clean, the lines or cords must be laid along the ledges, *abc*, and the loops of the cords are to be attached to the hooks in the axis on each side. The motion is then to be continued; when, as the other ends of the cords are fixed at *ff*, and the axis is not confined, the axis will gather up the cord, and be lifted, with the cylinder, out of the trough, and carried forward over the front edge; the axis running upon the edges of the wings, as represented at H, fig. 1 and 3. The door is then to be opened, and the potatoes discharged. By reversing the motion the cylinder will be again lowered into the trough, and the hooks released from the cords. If it be preferred, instead of loops the cords may have pins attached to them, to fit into holes in the axis. When the cylinder is full, it weighs about 80 lbs. A boy of eight or ten years old may raise it with ease. If the cylinder be only in part filled, it will require more strength to work it. It is scarcely necessary to point out, that the front feet of the washer must project sufficiently forward to allow a perpendicular from the centre of gravity to fall within the base, when the cylinder is raised out of the trough, as at H, fig. 1, 3.

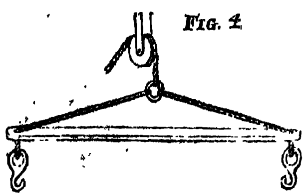
I am, Sir,
Your obedient servant,
C. W.

Nov. 15th, 1821.

BOILING POTATOES.

(From the preceding Correspondent.)

FIG. 4



SIR,—As every person has not the opportunity of procuring a Potato-Steamer, such as you describe in the same Number (23), I beg leave to mention another economical plan, by which a large quantity of potatoes may be boiled with very little fuel. For this purpose I have two strong close-worked wicker baskets, which fit the inside of my copper, each holding a bushel; these, when filled with potatoes, are lowered into and lifted out of the copper by a pulley, fixed above, and a rope, to which is suspended a stretcher and hooks, similar to what I have seen used in London to crane up crates of glass, earthenware, &c. with (see prefixed figure). By this contrivance the hot water* drains away from the pota-

* I believe the water in which potatoes and other roots are boiled is noxious in its qualities; perhaps it is owing to this being commonly retained with the potatoes, or to giving potatoes raw, or giving a bad sort to pigs, that Bonington Mowbray says they are injurious and deteriorate the meat. I have fatted many with half mealy potatoes (golden duns) and half barley flour, and my bacon has been generally much admired.

toes, when boiled, into the copper, and is ready boiling for the other basket to be immersed. By this plan a large quantity may be boiled quickly in succession, with a trifling addition of fuel, and now and then supplying the waste of water caused by evaporation. I have had this machine in use three winters, and, by these contrivances, a boy, about 16 years old, washed and boiled for me, in one winter's day, about 22 bushels of potatoes, besides picking them up and bringing them about 40 or 50 yards to the pump.

EVAPORATION.

It appears, from a long series of observations made by Doctor Bostock, that the following is the comparative rate of Evaporation, during the different months of the year, from a circular area of water, two inches in diameter :—

For January	·287	gr. per hour
February	·400	
March	·393	
April	—	no observation
May	·897	
June	·930	
July	·983	
August	·932	
September	·555	
October	·346	
November	·369	
December	·392.	

The average of the whole is 501 gr. per hour.

The greatest quantity of evaporation in one hour was 1·75 gr.; it was on the 4th of August, 1813: the least quantity of evaporation was on the 12th of November, 1812, when no loss of weight could be perceived. The greatest winter evaporation was on the 28th of November, 1812, amounting to 1·08 gr.; and the least summer evaporation on the 5th of August, 1813, amounting to ·25 gr. per hour.

It appears that when the state of the atmosphere is attended by either a very low or a very high barometer, it is less favourable to evaporation than the intermediate state. Nor does it seem unreasonable that this should be the case. Damp or wet weather, which is generally accompanied by a low barometer, is obviously unfavourable to evaporation; while, when the barometer is high, the atmosphere may be supposed to be more nearly saturated with moisture, and therefore less disposed to receive an additional quantity.

A close connexion was also observed between temperature and the rate of evaporation.

TO THE PROPRIETORS OF LARGE MANUFACTORIES.

Gentlemen,

I take this mode of addressing you on a subject in which you are deeply interested, conceiving it to be the most likely channel through which the communication I have to make may reach you generally.

I believe there is no difference of opinion now upon the question of giving education to the lower orders, or on the advantage of intellectual improvement to persons in the humblest condition of life; there has, in consequence, been, for some time, a general desire to afford to the people the means of instruction, and schools for teaching reading and writing have been multiplied in every part of the country.

But in merely teaching the people to read we only open to them the door to knowledge, and, unless we can induce them to pass the portal, the stores which lie within will remain useless to them. The people of the different Asiatic nations have, for an unknown period of time, had the advantage of being taught to read; but their languages supplying no practically useful works to which they could have access, no benefit followed the attainment, and they have not advanced their own condition beyond what it appears to have been two thousand years ago, and have not been able to furnish one solitary contribution to those means which minister to human happiness and enjoyment.

The necessity, therefore, of doing something more than merely teaching the people to read, has not, lat-

terly, escaped observation. Libraries, supported by subscriptions and donations from the higher orders, have been formed in different places for the use of mechanics and artisans; and establishments for teaching them the branches of science connected with their respective employments, upon the plan of the lectures given to mechanics in the Andersonian Institution here, have been made in Edinburgh and London, and in several of our large manufacturing towns. All this is in excellent spirit, and calculated to do much good. But to make these measures effectually and permanently useful, I am satisfied, from the observations which I have had an opportunity of making, that these establishments, after they are once set a-going, ought to be supported and conducted, in a great measure, by the people themselves, in place of being managed, as is the case at present, by their superiors.

We have had sufficient experience of the progressive relaxation which takes place in the management of public institutions by gratuitous directors from the higher classes, after the fervour which has set the machine in motion has begun to subside; and the apathy with which the common people soon come to receive every thing that is done by others, for their benefit, is matter of daily complaint. But, whenever they can be led to consider the undertaking in which they are engaged as their own, its success never ceases to be an object of interest to them. The importance, too, which attaches to the management of such a trust, gives rise to honest feelings of self-respect, which, besides a value of, perhaps, still greater consideration, have their weight in keeping up the interest I have mentioned.

These consequences, which we see taking place in the opposite systems of management, I have noticed, flow alike from principles inherent in our nature, and serve to indicate to us that the more closely we can frame our measures for the people, in correspondence with their natural feelings, the more permanently successful they are likely to be.

I have considered it right to preface the communication I have to make to you, Gentlemen, with these few general observations. I will now proceed to give you an account of a little Institution formed here for the improvement of a single body of workmen, the history of which will show what is possible to be accomplished by each of you in the business of education, independent of what may be effected by the greater general establishments I have taken the liberty of adverting to; and, if I am not mistaken, it will open up views with regard to the instruction of the people, more efficacious, more easily executed, and more practically applicable to the end, than any we are yet acquainted with.

The Gas Light Chartered Company of this city, in which I hold a considerable interest, and of whose committee of direction I have for some years been a member, employ constantly between sixty and seventy men in their works. Twelve of these are mechanics, and the remainder furnace-men and common labourers of different descriptions, forming altogether a community not very promising as a body to be incited to adopt measures for their own intellectual improvement.

A little more than three years ago, our manager at the works, Mr. James B. Nelson, proposed to these men to contribute each a small sum monthly, to be laid out in books to form a library for their common use; and he informed them that, if they agreed to do this, the Company would give them a room to keep the books in, which should be heated and lighted for them in winter, and in which they might meet every evening to read and converse, in place of going to the alehouse, as many of them had been in the practice of doing. That the Company would further give them a present of five guineas to set out with, and that the management of the funds, library, and every thing connected with the measure, should be entrusted to a Committee of themselves, to be named and renewed by them at certain fixed periods.

With a good deal of persuasion, Mr. Nelson got fourteen of them to agree to the plan, and a commencement was thus made. For the first two years, until it could be ascertained that the members would have a proper care of the books, it was agreed that they should not take them out of the reading-room, but that they should meet there every evening to peruse them. After this period, however, the members were allowed to take the books home; and, last year, they met only twice a week at the reading-room to change them, and converse on what they had been reading. The increase of the number of subscribers to the library was at first very slow, and, at the end of the second year, the whole did not amount to thirty. But from conversing with one another twice a week at the library upon the acquisitions they had been making, a taste for science and a desire for information began to spread among them.

They had, a little before this time, got an Atlas, which, they say, led them to think of purchasing a pair of globes; and one from among themselves, Alexander Anderson, by trade a joiner, who had had the advantage of attending two courses of the lectures in the Andersonian Institution, volunteered, about the beginning of last winter, to explain to them, on the Monday evenings, the use of the globes. Finding himself succeed in doing this, he offered to give them, on the Thursday evenings, an account of some of the principles and processes in mechanics and chemistry, accompanied with a few experiments. This he effected with a simplicity of illustration and usefulness of purpose that was delightful. He next, and while this was going on, undertook, along with another of the workmen, to attend in the reading-room during the other evenings of the week, and teach such of the members as chose it arithmetic.

For the business of this season, the members of the society, who conduct every thing themselves, have made a new arrangement.

The individuals of the committee have come under an agreement to give, in rotation, a lecture, either in chemistry or mechanics, every Thursday evening; taking Murray for their text-book in the one, and Ferguson in the other. They intimate, a fortnight before, to the person whose turn it is, that he is to lecture from such a page to such a page of one of these authors. He has, in consequence, these fourteen days to make himself acquainted with his subject, and he is authorised to claim, during that period, the assistance of every member of the society in preparing the chemical experiments, or making the little models of machines required for illustrating his discourse.

It is a remarkable circumstance in this unique process of instruction, that there has been no backwardness found on the part of any of the individuals to undertake to lecture in his turn, nor the slightest diffidence exhibited in the execution; this I can attribute only to its being set about without pretension or affectation of knowledge, and merely as a means of mutual improvement, and nothing, I conceive, could have been better devised for accomplishing this end. Indeed, I might with confidence say that, under this simple system of mutual instruction, which has grown out of the train of circumstances I have mentioned, these persons, many of whom, when they joined the society, were in a state of complete ignorance, have acquired a clearer idea and more perfect knowledge of the subjects which have been brought under their consideration, than would be found to have been obtained by any similar number of students who had been attending the courses of lectures given in the usual way by the most approved lecturers.

On the Monday evenings the society has a voluntary lecture from any of their number who chooses to give notice of his intention, on either of these branches of science, or upon any other useful practical subject he may propose; and there is, with the general body, the same simple unhesitating frankness and disposition to come forward in their turn, that exists among the members of the

committee with regard to the lectures prescribed to them.

I think it will be interesting, and may not be without use, to mention particularly the subjects of the different lectures that have been given since this plan was adopted. They commenced in the month of September, and are as follows:—

1. Upon solidity, inactivity, mobility, divisibility.
2. attraction, cohesion, and repulsion.
3. attraction of gravitation.
4. centre of gravity, expansion of metals.
5. magnetism and electricity.
6. central forces—all motion naturally takes a rectilineal line.
7. mechanical powers.
8. the lever, wheel, and axle.
9. the pulley.
10. the wedge and screw.
11. attraction of gravitation.
12. wheel carriages.
13. the primitive form of crystals.
14. hydrostatics.

The voluntary Lectures began at the same time, and have been as follows:

1. Upon the air-pump.
2. electricity.
3. an introduction to chemistry, principally to show chemical affinity.
4. the properties of the atmosphere.
5. the corn mill.
6. coal mining.
7. practical observations on the blasting of whin-rock.
8. boring, sinking, and mining, and the properties of Sir Humphry Davy's lamp.
9. the globes.
10. ditto
11. navigating a vessel from the Thames to the Orkney Isles.
12. the nature of carbonic acid gas.
13. a description of Captain Manby's invention for the safety of shipwrecked seamen.

The effect of all that I have been relating has been most beneficial to the general character and happiness of these individuals, and we may readily conceive what a valuable part of the community they are likely to become, and what the state of the whole of our manufacturing operatives would be, if the people employed in every large work were enabled to adopt similar measures. What might we not then be entitled to look for, in useful inventions and discoveries, from minds awakened and invigorated by the self-discipline which such a mode of instruction requires?

The Gas Light Company, seeing the beneficial consequences resulting from the instruction of their work-people, have fitted up for them, this winter, a more commodious room to meet in for their lectures, with a small laboratory and workshop attached to it, where they can conduct their experiments, and prepare the models to be used in the lectures. The men, last year, made for themselves an air-pump and an electrifying-machine, and some of them are constantly engaged during their spare hours in the laboratory and workshop.

The whole of the workmen, with the exception of about fifteen, have now become members of the society, and these have been standing out upon the plea that they cannot read: they are chiefly men from the remote parts of the Highlands or from Ireland—but the others say to them, 'Join us, and we shall teach you to read:' and I have no doubt of their persuading them to do so.

The rules of the society, which have been framed by the members themselves, are simple and judicious. Every person, on becoming a member, pays 7*s.* 6*d.* of entry money. This sum is taken from him by instalments, and is paid back to him again should he leave the gas-works,

or to his family or heirs, should he die. Besides this entrance money, each member contributes three halfpence weekly, two-thirds of which, by a rule made this year, go to the library, and one-third to the use of the laboratory and workshop. By a rule made at the same time, which I think a curious indication of the change of feeling produced in these men in the short period since the commencement of the society, the members may bring to the lectures any of their sons who are above seven and under twenty-one years of age.

The books now amount to above three hundred volumes, and consist of elementary works of science, and of history, voyages, and travels; some of the standard poets, a few of our best novels, and Shakspeare's works. The selection of the books purchased by the library funds is, in general, creditable to the members of the society.

They admit no books on religion into the library. The members say that there are among them men of a variety of persuasions—Presbyterians, Seceders, Methodists, Church of England men, and Catholics; each of whom would be for introducing books connected with their particular opinions, and thus give occasion to endless unprofitable disputes.

I hope you will agree with me, Gentlemen, in considering that there are valuable ideas on the subject of popular education to be gathered from the little history I have just given; and that what has been so usefully done by the people at the Glasgow Gas-work, is capable of being effected not only by the workmen in every manufacturing establishment, but in every part of the country where a few persons can be induced to form a society for mutual improvement. In places where there is a school-room, the use of it might be had for one or two evenings in the week, and the books might be kept in presses so placed as not to incommode the scholars. The schoolmaster, too, might probably make a valuable member of the committee. Where assistance was wanted to procure these accommodations, the pecuniary contributions of the more wealthy persons of the neighbourhood, for this end, would be doubly repaid to them in the improved character of all around them. The course of mutual instruction to be adopted in these little societies might be varied to suit every pursuit in life, and each society, prosecuting inquiry in the direction of the particular occupation or business of its own members, would, while they were improving themselves, be in the most likely state to furnish valuable contributions to the stock of general knowledge.

Since writing the preceding, which was some weeks ago communicated by me in a letter to Dr. Birkbeck, I have read the excellent article in the last Number of the Edinburgh Review, on the scientific education of the people, and am happy to find the general views I had been led to form on this subject, from what I had had the opportunity of witnessing in the different establishments here, sanctioned and confirmed by this able and enlightened writer. Indeed, there is so much information collected in this article on what has been done, in different parts of the country, in instructing the people, and so many suggestions with regard to what may yet be effected, that it is to be wished that it could be printed separately in a cheap edition, and circulated in every quarter of the country.

I am, with great respect,
Gentlemen,
Your obedient servant,
DUGALD BANNATYNE.

Glasgow, Dec. 25th, 1824.

INFLUENCE OF TEMPERATURE ON STONE BRIDGES.

M. Vicat has had occasion to observe a striking instance of the effect of change of temperature on a bridge constructed over the Dordogne, at Souillac. The bridge was of stone, had seven arches, each of above 24 feet span. It was expected that, as the masonry settled, the parapet-stones would separate slightly from each

other; and, in fact, this took place, but it occurred suddenly and precisely, during the very cold weather of February, 1824. Continuing the observation of what took place at the separation thus formed, it was found that the cement with which the portions of the cracks had been filled, remained undisturbed during the cold weather; but that as the warm weather came on, it was pressed out, and the joints were closed; and it was ultimately ascertained, that much of the expansion and contraction of the bridge was entirely thermometrical, depending upon the changes of temperature communicated to it by the atmosphere.

One of the most important and evident consequences of this action is, that large arches, exposed to the variations of natural temperature, are never in equilibrium; and M. Vicat remarks, that these effects are equally produced, and have been observed in arches constructed more than a year previous, and in those which have not been built more than two months; so that the thermometrical expansion and contraction of the stones does not appear to change by time.

GAS EXPLOSION.

Sir,—Reading in the *Stamford Mercury* of last week the report of a Meeting of the Proprietors of Gas Works in that town, and thinking that the following account, by Mr. Grafton, of the causes of accidents by Gas, could not fail of being interesting to your readers, I send it you in the hope that it may find a place.

I am, Sir,

Your obedient servant,

Aurum.

December 30th, 1824.

The account by the Newspaper states, that after a very flattering report of the state of the affairs of the Stamford Gas Company, &c. &c.

"Mr. Grafton, an engineer, was called upon for his explanation of the cause of the late accidents from gas which have occurred in London. Upon this subject, as well as upon the cause of the general impurity of the light, Mr. G.'s statement was certainly interesting and very satisfactory. He observed, that it was a matter of great surprise to him that more accidents had not happened, because the hurried and extremely unskilful manner in which the work had been executed in many places, had caused a constant leakage from the pipes. From this cause alone, the loss of gas in the streets of London would light a considerable town; and yet, under an escape so extraordinary, and the carelessness to which the immense number of lights were subject (distributed, as they are, in the metropolis by pipes extending for several hundred miles, and producing to the Companies a revenue of 200,000*l.*), still not more than six or eight accidents from explosion could be enumerated, and those, it was important to know, had proceeded from the main or service pipe in the street, which might admit of a sufficient quantity of gas to escape to form an explosive mixture with the atmospheric air. But the proportions were so difficult to form, that it was not one time in a thousand that explosion could take place in any situation.

"If the least quantity of gas escaped more than was necessary to form the precise proportion for an explosive mixture, and a lighted candle was brought to it, the simple ignition could only take place; on the contrary, if the least excess of atmospheric air prevailed, either there would be the same result without explosion, or no combustion: hence an accident from its escape at the burners, when the gas was not turned off, had never been heard of. Shops and apartments of dwelling-houses were not sufficiently close to keep the gas confined; but supposing that they were, the quantity emitted would never be sufficient to form an explosive atmosphere. Take a room, for example, of twelve feet each way, containing 1728 feet, with a burner emitting gas at the rate of five cubic feet per hour, which was the largest size that could be used, and allowing there was no loss of gas to form an explosive mixture in the apartment, the burner must be left open upwards of 50 hours, or at least two days and nights, which was not likely to happen. Mr. Grafton observed, he had no hesitation in saying, that if in this manner, for the sake of experiment, the gas in all the shops in London were allowed to escape (by the blowing out of the flames without stopping the stopcock), and a lighted candle were brought into any of the rooms, at any hour of the night, an explosion could not take place; assuming, of course, that every house had its ordinary ventilation.

"In speaking of the few accidents which have occurred, it was to be remarked, that the extent of pipes in the metropolis formed but a small part of the whole of what were used for thus conveying gas;

there are more than 100 towns already lighted; and the range of pipe, inclusive of what is used within the manufactories, might be computed at upwards of 10,000 miles.

"If the burning of gas had ever been deemed dangerous by its first promoters, particular instructions would have been given to prevent its escape; but the consumer had received no caution on this head; it had been left, as regarded the shutting out of the lights, entirely to his discretion. Great neglect had been the consequence; but Mr. Grafton believed, that not a single accident could be pointed out as having arisen from it. He was aware, that the late fires in some of the shops in London, as was generally the case, were attributed to the not turning off the gas; this, for the reason stated, could not be true; some of the accidents might have occurred from the escape of gas, but it would be found that they had, almost invariably, proceeded from the main or service pipe. At the outset, old gun-barrels were used as the best tubing which could then be had for the purpose; these were continually rusting away, and it was one of them which had occasioned a late accident, by the gas passing into a confined space in the shop through the channel of the earth in which the pipe was laid. Nothing could exceed the carelessness with which this work had been generally executed.

"With reference to the impurities of gas, it was an equally mistaken opinion that the smoke and effluvia which in too many instances discredit the light, was a natural result of its combustion, and could not be obviated. The cause of this complaint must be attributed to the indifference which had been generally shown on the subject; it was greatly neglected in all gas establishments, and in several of them the gas was not even purified at all. But would it be believed, that in some country towns more expense was bestowed on this essential part of the process, than had been allowed at several of the greatest works in London. In those places, too, where the gas was pure, it was made offensive by the improper construction of the burner, and waste from burning; this it was easy to obviate, by properly regulating the pressure of the gas (which seemed to be very little understood), and by the adoption of the meter.

"Had this state of things not occurred, oil gas would not have been known, and much of the valuable time would have been spared, which seems to have been employed in experiments to fix a scale of the comparative illuminating power of the two gases. That from oil had greatly the advantage in the comparison. The works were constructed by skilful and proper men; and the gas was generally made under the most favourable circumstances, while the best method for preparing coal gas had been in few instances understood, and nowhere sufficiently understood."

MEMOIR OF SIMPSON, THE MATHEMATICIAN.

The father of Thomas Simpson, one of the most eminent of English mathematicians, was a humble stuff-weaver, in the town of Market-Bosworth, in the county of Leicester, where young Thomas was born on the 20th of August, 1710. Intending to bring up his son to his own business, he took so little care of his education, that he was only taught to read English. But Nature had furnished him with talents, and a genius for far other pursuits, which led him afterwards to the highest rank in the mathematical and philosophical sciences.

Young Simpson very soon gave indications of his turn for study in general, by eagerly reading all the books he could meet with, teaching himself to write, and embracing every opportunity he could find of deriving knowledge from other persons. His father observing him thus to neglect his business, by spending his time in reading what he called useless books, and following similar pursuits, used all his endeavours to check such like proceedings, and to induce him to follow his profession with steadiness and better effect. But after many struggles for this purpose, the differences thus produced between them at length rose to such a height, that Simpson quitted his father's house entirely.

Upon this occasion he repaired to Nuneaton, a town at a small distance from Bosworth, where he went to lodge at the house of a tailor's widow, of the name of Swinfield, who had been left with two children, a daughter and a son, the latter of whom, who was about two years older than Simpson, had become his intimate friend and companion. And here he continued some time, working at his trade, and improving his knowledge by reading such books as he could procure.

Among several other circumstances, which, long before this, gave occasion to show Simpson's early thirst for knowledge, as well as proving a fresh incitement to acquire it, was that of a large solar eclipse, which took place on the 11th of May, 1724. This phenomenon, so awful to many who are ignorant of the cause of it, struck the mind of young Simpson with a strong curiosity to discover the reason of it, and be able to predict the like surprising event. It was, however, several years before he could obtain his desire, which at length was gratified by the following accident:—After he had been some time at Mrs. Swinfield's, at Nuneaton, a travelling

pedlar came that way, and took a lodging at the same house, according to his usual custom. This man, to his profession of an itinerant merchant, had joined the more profitable one of a fortune-teller, which he performed by means of judicial astrology. Every one knows with what regard persons of such a cast are treated by inhabitants of country villages; it cannot be surprising, therefore, that an untutored lad of nineteen should look upon this man as a prodigy, and regarding him in this light, should endeavour to ingratiate himself into his favour; in which he succeeded so well, that the sage was no less taken with the quick natural parts of his new acquaintance. The pedlar, intending a journey to Bristol fair, left in the hands of young Simpson an old edition of Cocker's Arithmetic, to which was subjoined a short appendix on Algebra, and a book upon Genitures, by Partridge, the almanack-maker. These books he had perused to so good a purpose, during the absence of his friend, as to excite his amazement upon his return; in consequence of which he set himself about erecting a genethliacal figure, in order to a presage of Thomas's future fortune.

This position of the heavens having been maturely considered, *secundum artem*, the wizard, with great confidence, pronounced, that, "within two years' time, Simpson would turn out a greater man than himself!"

In fact, our author profited so well by the encouragement and assistance of the pedlar, afforded him from time to time when he occasionally came to Nuneaton, that, by the advice of his friend, he at length made an open profession of casting nativities himself; from which, together with teaching an evening school, he derived a pretty pittance, so that he greatly neglected his weaving, to which, indeed, he had never manifested any great attachment, and soon became the oracle of Nuneaton, Bosworth, and the environs. Scarce a courtship advanced to a match, or a bargain to a sale, without previously consulting the infallible Simpson as to the consequences. But as to helping people to stolen goods, he always declared that above his skill; and over life and death he declared he had no power. All those called lawful questions he readily resolved, provided the persons were certain as to the horary data of the horoscope, and, he has often declared, with such success, that if, from very urgent reasons, he had not been thoroughly convinced of the vain foundation and fallaciousness of his art, he never should have dropt it, as he afterwards found himself in conscience bound to do.

About this time he married the widow Swinfield, in whose house he lodged, though she was then almost old enough to be his grandmother. After this, the family lived comfortably enough together for some short time; Simpson occasionally working at his business of a weaver in the day-time, and teaching an evening school or telling fortunes at night; the family being also farther assisted by the labours of young Swinfield, who had been brought up in the profession of his father.

But this tranquillity was soon interrupted, and Simpson driven at once from his home and the profession of astrology, by the following accident. A young woman in the neighbourhood had long wished to hear or know something of her lover, who had been gone to sea; but Simpson had put her off from time to time, till the girl grew at last so importunate, that he could deny her no longer. He asked her if she would be afraid if he should raise the devil, thinking to deter her; but she declared she feared neither ghost nor devil: so he was obliged to comply. The scene of action pitched upon was a barn, and young Swinfield was to act the devil or ghost; who being concealed under some straw in a corner of the barn, was, at a signal given, to rise slowly out from among the straw, with his face marked so that the girl might not know him. Every thing being in order, the girl came at the time appointed; when Simpson, after cautioning her not to be afraid, began muttering some mystical words, and chalking round about them, till, on a signal given, up rises the tailor, slow and solemn, to the great terror of the poor girl, who, before she had seen half his shoulders, fell into violent fits, crying out it was the very image of her lover; and the effect upon her was so dreadful, that it was thought either death or madness must be the consequence. So that poor Simpson was obliged immediately to abandon at once both his home and the profession of a conjurer.

Upon this occasion he fled to Derby, where he remained some two or three years, viz. from 1733 till 1735 or 1736, instructing pupils in an evening school, and working at his trade by day.

It would seem that Simpson had an early turn for versifying, both from the circumstance of a song written here, in favour of the Cavendish family, on occasion of the parliamentary election at that place in the year 1733; and from his first two mathematical questions, that were published in the Ladies' Diary, which were both in a set of verses not ill written for the occasion. These were printed in the Diary for 1736, and therefore must, at latest, have been written in the year 1735. These two questions being at that time pretty difficult ones, show the great progress he had even then made in the mathematics; and from an expression in the first of them, viz. where he mentions his residence as being

in latitude 52°, it appears he was not then come up to London, though he must have done so very soon after.

Together with his astrology, he had very soon furnished himself with arithmetic, algebra, and geometry, sufficient to be qualified for looking into the Ladies' Diary (of which he had afterwards for several years the direction), by which he came to understand that there was a still higher branch of the mathematical knowledge than any he had yet been acquainted with, and this was the method of *Fluxions*. But our young analyst was quite at a loss to discover any English author who had written on the subject, except Mr. Hayes; and his work being a folio, and then pretty scarce, exceeded his ability of purchasing. However, an acquaintance lent him Mr. Stone's *Fluxions*, which is a translation of the *Marquis de l'Hospital's Analyse des Infiniments Petits*. By this one book and his own penetrating talents, he was enabled in a very few years to compose a much more accurate treatise on this subject than any that had before appeared in our language.

After he had quitted astrology and its emoluments, he was reduced to great straits for the subsistence of his family, while at Derby, and this determined him to repair to London, which he did in 1735 or 1736.

On his first coming to London, Mr. Simpson wrought for some time at his business in Spitalfields, and taught mathematics at evenings, or any spare hours. His industry turned to so good account, that he returned down into the country, and brought up his wife and three children. The number of his scholars increasing, and his abilities becoming in some measure known to the public, he was encouraged to make proposals for publishing, by subscription, "A New Treatise of Fluxions," being the first of his many valuable works.

When Mr. Simpson first proposed his intentions of publishing such a work, he did not know of any English book, founded on the true principles of fluxions, that contained any thing material, especially the practical part; and though there had been some very curious things done by several learned and ingenious gentlemen, the principles were nevertheless left obscure and defective, and all that had been done by any of them in *infinite series* very inconsiderable.

The book was published in 4to, in the year 1737, though the author had been frequently interrupted from furnishing the press so fast as he could have wished, through his unavoidable attention to his pupils for his immediate support. The principles of fluxions treated of in this work are demonstrated in a manner accurately true and genuine, not essentially different from that of their great inventor, being entirely expounded by finite quantities.

Through the interest and solicitations of William Jones, Esq. Mr. Simpson was, in 1743, appointed Professor of Mathematics, then vacant by the death of Mr. Derham, in the Royal Academy at Woolwich, his warrant bearing date August 25th; and in 1745, he was admitted a Fellow of the Royal Society. The President and Council, in consideration of his very moderate circumstances, were pleased to excuse his admission fees, and likewise his giving bond for the settled future payments.

At the Academy he exerted his faculties to the utmost in instructing the pupils who were the immediate objects of his duty, as well as others, whom the superior officers of the ordnance permitted to be boarded and lodged in his house. In his manner of teaching, he had a peculiar and happy address; a certain dignity and perspicuity, tempered with such a degree of mildness as engaged both the attention, friendship, and esteem of his scholars; of which the good of the service, as well as of the community, was a necessary consequence.

It must be acknowledged, however, that his mildness and easiness of temper, united with a more inactive state of mind, in the latter years of his life, rendered his services less useful; and the same very easy disposition, with an innocent, unsuspecting simplicity and playfulness of mind, rendered him often the dupe of the little tricks of his pupils. Having discovered that he was fond of listening to little amusing stories, they took care to furnish themselves with a stock; so that, having neglected to learn their lessons perfectly, they would get round him in a crowd, and, instead of demonstrating a proposition, would amuse him with some comical story, at which he would laugh and shake very heartily, especially if it were tinctured with somewhat of the ludicrous or smutty; by which device they would contrive imperceptibly to wear out the hours allotted for instruction, and so avoid the trouble of learning and repeating their lesson. They tell also of various tricks that were practised upon him, in consequence of the loss of his memory, in a great degree, in the latter stage of his life.

It has been said that Mr. Simpson frequented low company, with whom he used to guzzle porter and gin; but it must be observed, that the misconduct of his family put it out of his power to keep the company of gentlemen, as well as to procure better liquor.

In the latter stage of his existence, when his life was in danger, exercise and a proper regimen were prescribed to him, but to little purpose; for he sunk gradually into such a lowness of spirits, as often in a manner deprived him of his

mental faculties, and at last rendered him incapable of performing his duty, or even of reading the letters of his friends; and so trifling an accident as the dropping of a tea-cup would flurry him as much as if a house had tumbled down.

The physicians advised his native air for his recovery; and in February, 1761, he set out, with much reluctance (believing he should never return), for Bosworth, along with some relations. The journey fatigued him to such a degree, that upon his arrival he betook himself to his chamber, where he grew continually worse and worse, to the day of his death, which happened May 14th, in the 51st year of his age.

EAST INDIAN LAPIDARY'S WHEEL.

The following description is from the pen of M. L. de la Tour:—This kind of Lapidary's Wheel is called, in the Tarmoule language, *courundum sane*. It is composed of corundum, more or less finely powdered, cemented together by lac resin; the proportion, by volume, is two-thirds powdered corundum, one-third lac resin. The corundum powder is put into an earthen vessel, and heated over a clear fire; when of a sufficient heat, which is the case when a small piece of the resin readily fuses, the resin is added in portions, stirring at the time to form an intimate mixture. When made into a paste, it is put on a smooth slab of stone, and kneaded by being beaten with a pestle; it is then rolled on a stick, repeated several times, continually kneading it until the mixture is perfectly uniform. It is then separated from the stick, laid again on the stone table, which has been previously covered with very fine corundum powder, and flattened into the form of a wheel by an iron rolling pin. The wheel is then polished by a plate of iron and corundum powder; and, finally, a hole is made through the middle, by a heated rod of copper or of iron. These wheels are made of a grain more or less fine; the coarser perform the first rough work, and the finer cut the stones. They are mounted on a horizontal axis; and the workman, sitting on the ground, makes them revolve with a spring-bow, which he moves with his right hand, at the same time, with his left, holding the stone against the wheel; the latter being, from time to time, carefully moistened and powdered with corundum powder. The polish is given by wheels of lead and very fine corundum powder.

It is supposed that this kind of lapidary's wheel may be imitated with advantage in Europe; the powder of emerald or diamond being used in place of that of corundum.

RAILWAYS.

Sir,—I feel reluctant to differ from the writer of a paper contained in your last Number, under the head of Railways; but as truth is our mutual object, I request permission to express my doubts of the reality of a principle laid down in it; namely, that the friction being the same, or nearly so, in all velocities, it would require no more power (setting aside the resistance of the air) to impel a carriage at any given rate, than it would to impel it at half that rate. Now, admitting that the friction does not increase with the velocity, is it not an established principle in mechanics, that the friction or resistance being the same, the power required will be in proportion as the velocity? Suppose, for instance, the power employed be that of a steam-engine, and that the piston must make a certain number of strokes to produce a given number of revolutions of the wheels, would it not require double that number of strokes to produce double the number of revolutions in the same time? and would not the quantity of steam required, and fuel to create that steam, be increased in the like proportion?

With my best wishes for the continued usefulness and success of your valuable Magazine,

I remain, Sir,
Your obedient servant,
G. W.

Norwich, January 4th, 1825.

NEW PIECE OF ARTILLERY.

A Report was read, at a late Meeting of the French Academy of Sciences, on certain experiments made at Brest, on the effects of a new kind of Artillery invented by a M. Paixhan. The piece (*canon à bombes*), of which trial was made, had a bore eight inches in diameter. The object fired at was an old vessel of 80 guns; each discharge caused such injury as would entirely have

disabled it from continuing in action. The fire of the new piece, charged with ten pounds of powder, was much superior to that of a thirty-six pounder, having a charge of twelve pounds of powder, at similar angles. The Commission who witnessed the experiments were unanimous as to the advantages which would be produced by the adoption of this new piece of artillery in the defence of places, and in floating batteries placed at the entrance of harbours. They were also of opinion that, ultimately, they would be introduced on board vessels without inconvenience, and thus have the effect of establishing a sort of equilibrium between vessels of different dimensions.

SECURITY OF STEAM-ENGINES.

The Royal Academy of Paris has been called upon by the Government to report on the means proper to be adopted for the prevention of accidents and injury from the explosion of Steam-Engine Boilers. The means proposed had the double object of preventing the rupture of the boilers, or, in case of their destruction, preventing injury to neighbouring buildings. They directed that the boiler should be proved by the hydraulic press, with a force five times that which they would have to bear during the working of the engines: that a safety-valve should be attached to the boiler and locked up, the valve being so loaded as to open at a pressure just above that by which the boilers have been tried: that the boiler should be surrounded by a wall of masonry one metre (39.371 inches) in thickness; an interval of a metre being left between the boiler and the wall, and again between the wall and the neighbouring buildings. Another precaution has been added by M. Dupin (whom we congratulate on his deserved elevation to the rank of Baron), and adopted by the Academy; namely, the introduction of a metallic plug into the upper surface of the boilers, formed of such an alloy as should melt at a temperature a few degrees above that at which the engine is intended to work.

In consequence of this application, it became necessary to form a table of the pressure and temperature of vapour. The Academy appear very doubtful of estimations as yet published, but give the following table, up to eight atmospheres, as nearly correct: above that, they say, it was impossible to go without farther experiments.

Elasticity in atmospheres.	Height of mercury.	Temperature of Fah.	Pressure on a square inch.
1	29.92 in.	212°.0	14.61 lbs. avoir.
1½	44.88	234.0	21.92
2	59.84	251.6	29.23
2½	74.80	264.2	36.44
3	89.76	275.0	43.84
3½	94.73	285.3	51.15
4	119.69	293.4	58.46
4½	134.65	302.0	65.76
5	149.61	309.2	73.07
5½	164.57	316.4	80.37
6	179.53	322.7	87.69
6½	194.49	328.5	94.99
7	209.45	334.4	102.30
7½	224.41	339.[illegible]	109.60
8	239.37	343.4	116.92.

It is advised that no direction should be given for the composition of the fusible plugs or plates, but their preparation entrusted to some competent person, who should be responsible for the accuracy of their

fusing points. The fittest place for them, all things being considered, is the upper surface of the boiler. Their proper diameter and thickness have not yet been ascertained; they should be such as to bear the force of the vapour without risk of breaking, and, when the plate is fused, to leave an aperture sufficient for the ready escape of the vapour.—*Ann. de Chimie*, xxvii. 95.

NATURAL STANDARD OF LINEAL MEASURE.

SIR,—From the silence hitherto observed in your valuable Magazine on the subject of a Natural Standard for Weights and Measures, it is presumable your junior Correspondents, at least, may not be acquainted with what is meant by *a natural standard*. I shall trouble you with a few lines in consequence, hoping they may excite a spirit of inquiry; first premising that a standard of length, weight, or capacity, is as much a *desideratum* in science as a perpetual motion. In fact, it might be of more utility generally, inasmuch as it might, in some measure, afford an insight into first principles, which would be a standard of truth in all scientific investigations; whereas, a perpetual motion, without our being acquainted with the cause of motion, would add nothing to the correctness of science; and if such a motion were not controllable, it would answer no purpose whatever as a timekeeper or as a power.

By a standard of lineal measure, founded in Nature, is meant the length of any thing which is always the same; from which to take our measures for trade, and to which we refer, to prove the correctness of those measures; so that, if these latter were all destroyed, the like could be again obtained by referring to the natural standard. Thus, were there a certain species of stones, or trees, or a single any thing whatever, that either arrived at a certain height, and was subject to neither increase nor diminution, or remained always the same in any of its dimensions, the whole or a proportion of such dimensions would constitute the natural standard, from whence to derive a lineal measure, with which at all times to compare, and from which to renew our measures, were they destroyed by accident or time.

Taking the length of this natural standard, its half, fourth, or any other proportion, we have a lineal measure for all purposes; subdivision and multiplication of the same affording inches and miles. From this, to deduce a measure of capacity, or measure for liquids, it is only necessary to take some certain proportion of the lineal measure, as the side of a cubical vessel in the clear; this proportion being established, like all others for similar purposes, by statute, there would be no difference in the vessels made for it, and no difficulty in proving their correctness. Perfect uniformity would thereby obtain in these respects throughout the kingdom, and statute measures, of all sizes, could be found by proportions and multiples of the length of the side of the adopted measure. For weight, take the weight of the full contents of the cubical vessel of water at its maximum of density, and proportions of that weight give all inferior weights. In this manner may be obtained a measure of length, of capacity, and of weight, from having an invariable lineal standard in nature. The proposition is, where is such a standard to be obtained, all terrestrial bodies being subject to change unceasingly?

Time is the adopted standard; but time is caused by motion, as we should have no idea of time could existence continue, were there nothing in motion. Time is as inseparable from motion, as motion from matter. Hence the motion of the sun in his orbit gives the time, and machines that move simultaneously with the sun are called time-keepers; the correctness of which depends on their hands pointing to the same mark on their dials every time the sun is in the same part of his orbit; which may be taken as a proof that the velocity of the sun is equal in any one orbit to what it is in another; and hence motion, or the cause of time,

and time, are considered synonymous. Taking, then, the length of a pendulum that vibrates with the proportion of the sun's orbit, which agrees with a second's motion of the time-keeper, that length is at present the natural standard lineal measure, from which our various measures of length and capacity, and our weights, are or may be deduced. But it has been found a matter of difficulty to ascertain the exact centre of suspension of the pendulum rod, which is indispensable towards determining the precise length of that rod; hence I would suggest the following:

From what has been stated, and due reflection, it will be found that motion alone presents the means of obtaining a lineal standard which is founded in nature; and that whatever limited motion which corresponds with any division of the correct time-keeper's motion, will afford a determinate measure of space for a standard of length. Such might be obtained from the length of a plane, down which a cylinder rolls in a second. But this affords no standard for imitation, should it be lost. On the contrary, cylinders roll down planes of different lengths in the same time, if they be proportional to the lengths and elevations of the planes they roll down; in which case there would be no knowing which is the length of the original plane that was adopted, after its loss or destruction. But as all bodies, no matter how different they are in volume or quantity of matter, fall in equal times in vacuo, might not the length of space passed through in a second be ascertained with precision; and if so, would not that length be a lineal standard founded in nature, and always attainable?

Some of your numerous Correspondents will, I hope, point out the misconceptions I may have formed on this subject, and present the matter in a clearer light to those who may be led to follow it up: as a stimulus to such I would say, that the study of motion is that of the only acting power which nature possesses, and, as such, may lead to the most sublime discoveries.

T. H. PASLEY.

ARTIFICIAL PUZZOLANA.

An excellent artificial Puzzolana is now prepared in France, by heating a mixture of three parts clay and one part slacked lime, by measure, for some hours, to redness.

IMITATION CHINA INK.

Dissolve six parts of isinglass in twice their weight of boiling water; and one part of Spanish liquorice in two parts of water. Mix the two solutions while warm, and incorporate them, by a little at a time, with one part of the finest ivory black, using a spatula for the purpose. When the mixture has been perfectly made, heat it in a water-bath till the water is nearly evaporated; it will then form a paste, to which any desired form may be given, by moulding it as usual. The colour and goodness of this ink will bear a comparison with the best China or Indian ink.

CORRESPONDENCE.

Communications received from—R. Bond—M. M.—Aliquis—A Shipwright—Philo—D. C.—Peter Q.—N. S.—W. Young—J. W.—Old Seaman—Furnace—W. T. B.—Tempus—An Old Sexton—Mr. Amey—B. B.—Inquisitor—Neutral—F. A.—Diaper—A Combination Man—Dr. Jemmet—A. B.—Oldstyle—Margaret—T. T.—Chemicus—× × S.—A Correspondent at Exeter—A Cornish Miner—D. R.

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" Whatever busies the mind without corrupting it, has at least this use, that it rescues the day from idleness; and he that is never idle will not often be found vicious."--*Dr. Johnson.*

SAND CLOCK.

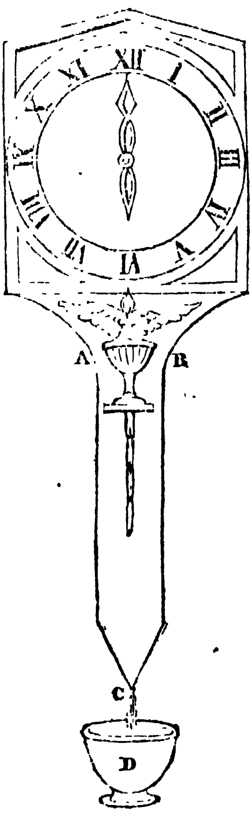


Fig. 1.

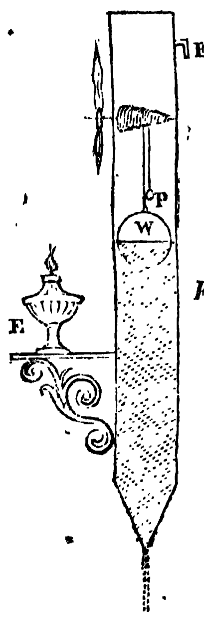


Fig. 2.

SAND CLOCK.

Sir,—Should the following description of a Sand Clock meet your approbation, its insertion in your very interesting Miscellany will oblige,

Sir, yours respectfully,

C. D. W+8.

Parsondrove, Nov. 5th, 1824.

Description.

ABC is a hollow tube, of either wood or metal, and filled with very dry sand; a small aperture at C permits the sand to escape into the bason, D. On the top of the sand in the tube is placed a weight, W (fig. 2.), to which a string is tied, with a billet, *p*, at the other end, and which is passed over the axis, on which the pointer or index is fixed. A small cone on the axis, in which is a number of grooves for the string to pass over, serves to regulate the string, and when once properly adjusted, will go with great accuracy. E is a lamp or candle placed on a bracket, to show what o'clock it is in the night, in a sick-room or nursery, where a light is burned. F is a hook to hang it up by, either against a wall or on a chair-back.

RAREFACTION OF AIR.

Sir,—A Correspondent in your Magazine of most useful information, No. 72, page 254, has given a neat and correct exemplification of the rarefaction and pressure which air is subject to. Perhaps the same, or some other intelligent writer, will do those of your readers, who, like myself, are ignorant of abstruse matters in science, but covetous of information, the favour of elucidating the phenomenon of rarefaction in cases where fire, as in the experiment alluded to, is made use of. I can readily conceive how air becomes rarefied by reduction of quantity in a given space. Here the matter is clear enough—half the contents of the receiver of an air-pump being taken away, the other half fills the receiver: what remains is, of consequence, less dense and more attenuated, which constitutes rarefaction. In this state its pressure is lessened, and a tube, having one end in quicksilver and the other opening into the receiver, would be proportionally filled by the quicksilver ascending in it. This result is unavoidable, and the circumstances producing it perfectly intelligible: not only is external pressure on the upper orifice of the tube lessened, but the atmosphere on the outside of the receiver is completely separated from the included air, and thereby prevented from pressing on that air and on the ascending fluid: in a word, the matter or proximate cause of pressure is taken away. But, in *rarefying air by fire*, the circumstances are widely different. Thus, if fire be applied to the upper orifice of a tube, the lower end of which is immersed in water, the water will ascend in the tube: hence it is conclusive, the air's pressure is removed from the water in the tube in some degree, and hence the air is said to be rarefied. That these are facts, the ascent of the fluid renders indisputable. But why the water should ascend, puzzles me not a little, as the atmosphere is not separated by any rigid substance from the top of the tube, and the rarefied air over that top must be under the pressure of the entire of the atmosphere above it. How is it that the rarefied air which is on and in the tube supports the atmosphere over it, and yet is not pressed by that which it supports. If I weigh one hundred weight, and am balanced by an equal weight in the opposite scale, and then take a ten-pound weight into my lap, the scale is pressed nothing less by my lap being between the weight and it, as it takes not less than an additional ten pounds in the other scale to form the equilibrium. In the same light I take the atmospheric pressure over the rarefied air, and cannot avoid wondering how it is the rarefied air averts the effects of the former from the water in the tube; for, if it press the air away from it, it should press the water beneath as much, and keep it from ascending.

Your Correspondent says, "When the paper has burnt for a few seconds, strike the mouth of the glass against the palm of your left hand, and it will remain firmly fixed to it *for a considerable time.*" Pray why not until the glass be taken off the

hand? What subverts the rarefied state of the included and insulated air?

Your constant reader,
T. HARTSHORNE.

TO IMPROVE GUNPOWDER FOR BLASTING.

SIR,—Having, some time since, had occasion to make some trials of the strength of different samples of Gunpowder, and ruminating on the phenomenon of expansion of air, the accounts illustrative of which I consider no way satisfactory, the ideas I formed on the subject led me to the conclusion, that oil added to gunpowder might possibly increase the expansive power of the latter, and, upon trial, this appeared to me to be the case. I half filled a tin cylindrical two-ounce snuff canister with gunpowder, on the top of which I poured some locksmith's oil; then, with the cover on, I shook the powder until the whole had become similar in colour, and no appearance of moisture remained. On comparative trials I found the oiled powder stronger than the same powder not oiled; but, not having a regular powder proof, I was obliged to decide to the best of my judgment, which may possibly have been influenced by an inclination to flatter myself that I had fallen upon a discovery that might be productive of some general good. I am of opinion, from the appearance of the oiled powder, after long keeping, and although excluded from air, that it deteriorates faster than powder not oiled. I judged so from its effects in the fire, as well as from its novel whitish appearance, as if some small degree of efflorescence had taken place, which, if so, would be greater in a less confined situation. But, if the conjecture be not altogether imaginary, that *newly* oiled powder is improved by the process, it is probable some advantage might be taken of the hint in the application in mining, but most particularly in the blasting of rocks.

Being, in several instances, much indebted to the liberal communications of your Correspondents, I take this opportunity of throwing in my mite in return, and shall be most happy at all times, as recollection serves and circumstances present, to communicate whatever may appear likely to be anywise useful—"for good communicated, more abundant grows."

I am, Sir,
Your obedient servant,
ETCETERA.

RAISING WATER BY WIND.

SIR,—At one time of my life I entertained strong and grand opinions of being able to discover the perpetual motion, which, I need scarcely mention, I have not yet effected; but I have this satisfaction to boast of, that my time and labour were not thrown away, as I learned much from my own misconjectures; that is, by persevering until I discovered wherein my errors of opinion consisted. I was inclined to think the discovery was to be made by hydrostatic means, and, while under that impression, conceived that water might be raised by atmospheric pressure with less expense of power than is generally the case. It occurred to me that the pressure of the air on the top of an open tube might be diverted out of its vertical direction by means of a current of wind; and this conjecture was supported by the fact, that the pressure of the waters of the ocean is no hindrance to currents of water running in all directions through the sea as the Gulph Stream which crosses the Atlantic Ocean affords sufficient evidence. To put the matter to the test of experimental proof, I filled a saucer with water, into which I put a glass funnel, the smaller orifice being above the water about eight inches; then, having an assistant to blow a pair of kitchen bellows, so as to make the wind pass over the top of the tube, we effected the desired object. I held the tube of the funnel with my hand grasped round it, and let the nose of the bellows rest on the side of the uppermost finger. While the operation of blowing went on, my assistant raised and lowered the bellows as I

gave directions; and, with the hand on which the bellows-pipe rested, I humoured the direction of the pipe, so as to prevent the wind descending to the water in the funnel, and to cause the entire of the orifice of the funnel to be included in the blast which was passed over it. The result was, that the water ascended in the funnel, filled it, and was blown over as long as the operation of blowing was continued. I next tried a thirty-inch barometer tube, open at both ends, and the result was as before, only the water started up with much greater rapidity than with the funnel. The reason is obviously the insufficiency of the blast of a pair of small bellows, and the difference in quantity of air to be removed from within the tubes. I tried the like experiment with a pair of smith's bellows; but these being fixed to the fire, the blast was conveyed from them through about eight feet of lead pipe, the length of which, from the bellows, caused the wind at its exit to have little or no effect in removing the air's pressure. These hints may possibly be improved on, for which reason it is I request you will be pleased to lay them before your readers; in a future paper I may continue my observations on removing atmospheric pressure by the wind.

JERNIGAN.

GALVANISM.

SIR,—Galvanic Electricty is an interesting subject, not only in a philosophical, but in a medical point of view, as it is represented to be the most efficient stimulant at present known for the removal of disorders indicating a general or local deficiency of nervous energy; such as palsy, deafness, obstinate costiveness from torpidity of the liver, &c. The professors of galvanism, &c. hold out expectations of removing such disorders, by six weeks' application of this philosophical remedy, at, I believe, a guinea per week. Now, if to this be added the expense of a residence in London, your mechanical readers in the country will obviously, for the most part, be utterly unable to avail themselves of a remedy, however real, so dispensed; and if they read the books which have been published on such subjects, they will find some of them, at least, less calculated to teach them the proper mode of applying galvanism, than to point out the residence and the successful practice of galvanian doctors.

Such being the case, perhaps the less opulent among your readers may some of them be gratified to learn the fundamental principles of galvanism at a small expense; and such is the object of the present communication, both with respect to myself and others.

A galvanic trough may be made of beach, well dovetailed together, and painted, both with a view to preserve the wood, and to insulate the galvanic fluid; all oily and resinous substances being non-conductors of electricity. In the sides and the bottom of the trough must be made grooves, about one-eighth of an inch deep, to receive the edges of the galvanic pairs of plates, and to retain them firmly in their places, leaving spaces between them not exceeding three-eighths of an inch.

The inside of the trough must be covered with cement—as one part bees-wax and two parts resin; and the plates must be put in when both they and the cement are hot, so as completely to insulate the cells or spaces between them. A hot wire, or other convenient instrument, must be used to perfect the cementing process; and the cement must finally be scraped from the sides of the plates, as it may be presumed their power is diminished in proportion as they are covered by a non-conducting substance. The pairs of plates, as most of your readers may be aware, consist of zinc and copper soldered together, at least along their upper edges, which are exposed to view, the other edges being covered by the cement.

The copper plates may be almost as thin as possible; the zinc plates being most exposed to oxidation, I imagine they ought to be from 1-16th to 1-12th of an inch thick; they may be cast, or obtained in plates. In placing the double plates in the trough, care must be taken that all the similar metals may be to the right or left, so as to form a regular series of copper, zinc—copper, zinc, &c. alternately. This being done, when the cells are nearly filled with water, acidulated with (say 1-30th part) of sulphuric or muriatic acid, the positive electricity will accumulate toward the zinc end of the trough, and the negative electricity will be exhibited, of course, at the opposite extremity. The sides of the trough should be raised nearly three-fourths of an inch above the tops of the metallic plates, to facilitate the pouring on and regulation of the acidulated water, and the trough should be well rinsed when put aside, to prevent any unnecessary oxidation of the zinc plates.

The trough being charged, the galvanic influence, either in shocks or a

continued current, may be passed through the body in various directions (even at the same time) by metallic communications with any of the cells toward the opposite ends of the trough. As the epidermis, or outer skin, *when dry*, is a non-conductor of galvanism, it should be *soaked* with a solution of salt and water, by means of a wet sponge, or leather, or metal plates covered with leather, and bound to the body, when necessary, by fillets, &c. The effects will be found very different, according as the parts operated upon are more or less sensible or muscular. Flashes of light will appear in the eyes, and a peculiar taste will be perceived, if almost any part of the head be galvanized. Operators should be careful not to pass more than the power of ten or twelve plates, at first, through the ears, as they will find it produces a very peculiar, though generally a momentary sensation of giddiness.

Now, as my object is partly to give and partly to obtain information, I hope some of your more experienced and intelligent Correspondents will be so obliging as to answer the following queries, and to communicate any other information on this subject which they may deem interesting to your readers in general:—

What is the usual size and number of the plates employed in medical galvanism? Wilkinson, in 1804, employed fifty or sixty pairs.

Is there any better mode of conducting the fluid through the skin than what is described above? I propose this query, because some professors hold forth the expectation of administering galvanism without causing any *pain* or uneasiness. Whether this can be performed by any other means than using few plates, and such as are of small dimensions, I know not; but it is a fact, that a series of thirty double plates, two inches square, often cause a pungent pricking sensation in the skin, in some parts, which few would choose to endure for many moments in succession.

As the magnetic influence has an evident alliance with galvanism, and as they have been used in conjunction to produce some curious rotatory machines, I beg to ask your philosophical readers, whether any circular galvanic troughs have been constructed, with a view to prove whether, if suspended, the influence of a magnet would cause them to rotate?

Is it known whether a large series of magnets, immersed at their extremities in separate glasses of pure or acidulated water, after the manner of Volta's experiments, exhibit any galvanic power on connecting their extremities with the interposition of parts of living animals, &c.?

Professor Hare, of Pennsylvania, states that the galvanic power is much increased, even without insulation, by enclosing plates of zinc in a kind of copper case, open at top and bottom; and Sir H. Davy has proved, that a *small* plate of iron or zinc will prevent the corrosion of a *very large* surface of copper exposed to the action of sea-water. The consideration of these circumstances induces me to ask, whether it has been proved by experiment how far the thickness, or the extent of surface, of the copper plates, influences the galvanic power, independently of a correspondent alteration in the plates of zinc?

The *modus operandi* of the galvanic fluid seems to me to be so completely unintelligible, that it may be reasonably presumed, that great discoveries yet remain to be made in this line by those who make it their ambition to pry into the mysterious secrets of nature.

I am, Sir, yours, &c.
T. B.

PERPETUAL MOTION.

SIR,—If the following observations (which were made by me many years since on a slip of paper, while perusing some works relating to the controversy of finite particles, and which lay unnoticed in a drawer, till accident a few days ago brought them to light) be worth your notice, I am sure they will meet with your attention.

I am, Sir, yours, &c.
ESPERANCE.

Dec. 1813.—The theory of a finite quantity of matter being composed of an infinite number of particles, as to the truth of which mathematicians are divided in opinion, may perhaps be compared to that of perpetual motion. For mathematicians, on the other side, say, it is a contradiction to suppose any thing of finite dimensions can be composed of infinites, which certainly appears correct in principle; yet, on the other hand, it is argued, that no certain number of parts of which any matter consists can be supposed, without having an idea of a greater number, even *ad infinitum*. On the same ground, although no certain time can be pointed out which forms the maximum of the movement of machinery, nor can any length of time be conceived without an idea of greater extent, to which, by increasing either the moving power, or the complication of the

inferior parts, the motion may be carried: yet perpetual motion, as a mechanic principle; is visionary.—Query, will this at all explain the subject which has been so long controverted, as it proves the maintainers of both sides of the question to be to a certain degree right?

This argument, of course, alludes to engines, where a mechanical power is the moving force, and not a chemical power, as the electrical pendulum.

THE BALANCE.

Sir,—Your Correspondent G. B., page 234, who is so much "surprised" at C. D.'s mentioning the singular property of the Balance, will doubtless be still more surprised when he is told, that the "reason" which he has found "so clear," is not the reason of the effect stated by C. D. He will, perhaps, wonder still more when it is made known to him, that to produce the effect mentioned by C. D., the pressure may be applied any where between the pivots of the two scales; and his eyes will be extended still wider with astonishment when he is informed, that a pressure infinitely great, exerted in the way he describes, will not increase the *weight* one grain! All this may be very puzzling to G. B., but it is nevertheless true; and unless G. B. can discover and will acknowledge his error, I must do him the favour (unless undertaken by some more able Correspondent) to prove, to his entire satisfaction, that he knows nothing whatever about the matter he treats so confidently in page 234.

You must allow me a few more lines to express my unqualified disapprobation of the style of writing I have here adopted; but it is the style of G. B., and he cannot justly complain of what he endeavours to inflict. We are all essentially ignorant, and he who is less wise than his neighbour is surely sufficiently unfortunate, without being insulted by the contempt of his superiors.

I am, Sir, yours, respectfully,

S. Y. a young Engineer.

[We think our "Young Engineer" judges severely of the style of G. B., and, at any rate, imitates it but too well. Another of our Correspondents (W. L.) remarks, "that if by pressing upwards we are to understand pressing *perpendicularly* upwards, against the point of the beam from which the scale in which the man stands is suspended, the assertion is not correct; for it is evident that the force with which the man presses perpendicularly upwards, will, by its reaction, act upon the scale with but an equal force, as action and reaction are equal and contrary. I suppose," he continues, "the proposition should have been stated as follows, the truth of it in which shape is demonstrated by writers on mechanics:—If a man placed in one scale of a balance, and counterpoised by weights in the other, press upwards, by means of a stick or otherwise, against any point in the beam, except that from which the scale is suspended in which he stands, he will preponderate."—Ed.

ARTIFICIAL STONE.

Mr. Joseph Aspdin, of Leeds, has taken out a Patent for a new mode of producing an Artificial Stone or Cement for the covering of Buildings. He calls it Portland Cement, from its resemblance to Portland stone; its component parts are as follow:—A given quantity of limestone, of the kind usually employed for mending roads, is to be pulverized by beating or grinding, or it may be taken from the road in a pulverized state, or in the state of puddle: this, when dried, is to be calcined in a furnace in the usual way. A similar quantity of argillaceous earth or clay is then to be mixed in water with the calcined limestone, and the whole perfectly incorporated, by manual labour or by machinery, into a plastic state. This mixture is then to be placed in shallow vessels for the purpose of evaporation, and is to be submitted to the action of the air, the sun, or the heat of fire, or steam conducted by pipes or flues under the pans of evaporating vessels.

This composition, when in a dry state, is to be broken into lumps of suitable sizes, and is then to be calcined again in a furnace similar to a lime-kiln, till the carbonic acid has been entirely expelled. The mixture so prepared is then to be pulverized by grinding or beating, and, when reduced to a fine powder, is in a fit state for use, and with the addition of so much water as will be sufficient to bring it into the consistency of mortar, will, when applied to its purpose, make a compact and durable artificial stone, equal to the Portland stone itself.

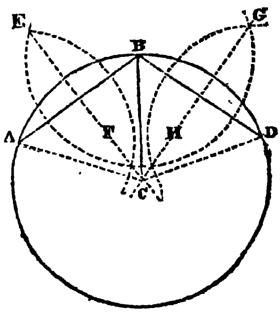
MECHANICAL GEOMETRY.—No. VI

(Continued from page 234, No. 71.)

PROBLEM IX.

Three points being given, not in a straight line, to find the centre of the circle that shall pass through these points.

Let ABD be any three points not in the same straight line, it is required to find the centre and describe the circle through these points.



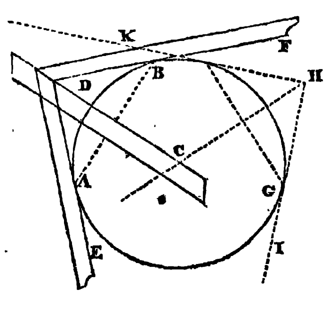
Join AB and BD; then, with any opening of the compasses (greater than their half) from the centre, A, describe the arc, EF, and from the centre, B, describe EF to cross it in the parts E and F; in the same manner from B and D as centres describe two arcs crossing one another in G and H; draw the lines EF and GH, and produce them till they cross in C; then is C the centre of the circle required; and with CA, CB, or CD, as radius, describe the circle which will pass through the three points, ABD, as was required.

Note.—The truth of this Problem is evident, for the line EF bisects AB (by Problem VII. Part II.), and (by Theorem IV. Part II.) the line EF is drawn from the centre of the circle, as it bisects the chord AB; and the two lines EF and GH both tending to the centre of the circle, they must meet each other at the centre.

It may be here observed, that in the actual construction of this Problem, it is unnecessary to join AB and BD, or to draw the lines AC, BC, and DC, and I have only introduced them that the truth of the Problem may be manifest.

PROBLEM X.

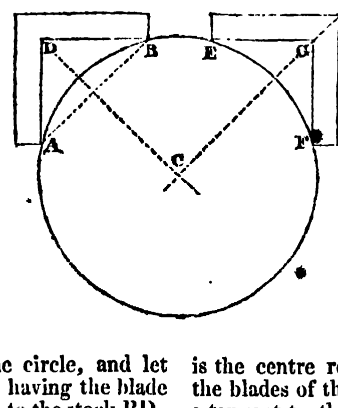
Having a circle, or segment of a circle, to find its centre by means of a *square* and *mitre square,* without the use of compasses.



Let ABG be any circle, or part of a circle; apply your square so that the internal edge of the blade and stock shall touch it, as at A and B, as shown in the figure; then take your mitre square, and place it at the angle, D, of your square, and draw a line along its edge, as DC, in the circle; now the line DC must pass through the centre of the circle, for it bisects the chord, AB (by Theorem IV. Part II.); now, if we move the square into any other position, as shown at KHI, and draw the line HC with the mitre square, in the same manner as before, that line will also pass through the centre of the circle, and, consequently, the intersection of these lines DC and HC at C will be the centre required.

Note.—This Problem will be found not only of great use to cabinet-makers, for finding the centre of circles for fixing the pillars on tables, &c. and to the turner for recentering a piece of work after it has been taken out of the lathe, and the original centre is either obliterated or cut off; but, to the millwright and wheelwright, it will be found a very easy process for truly centering their work.

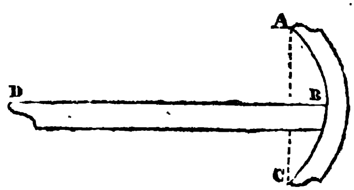
It may be here observed by the workman, that, when the circle is large, it will be difficult to find a square or mitre bevil long enough, as in the figure here shown: the *square* must be equal at least to the radius of the circle, and the mitre bevil considerably more. I will now, therefore, show how that objection may be dismissed, and the operation performed with as much accuracy when the square is not equal in length to the radius, or the mitre bevil not long enough to reach to the centre of the circle; but it will be necessary to observe that the stock and blade of the square must be equal in length to each other, or DF must be equal to DE, and though DC may not be long enough to reach to the centre, it will tend to it, and the line drawn by it may be continued by means of a straight edge. Now, in order to show how this is done,



Let ABEF be the circle, and let ADB be a square, having the blade AD equal in length to the stock BD; apply it, as shown in the figure, so that its ends meet the circle in the points A and B, and, with a mitre square, draw a line in the direction DC, which will tend to the centre of the circle; in the same manner apply the square to any other part of the circle, as at EF, and draw GC by the help of a mitre square; then the intersection of these two lines (or, if necessary, produced), DC and GC, is the centre required; for, though the blades of the square do not form a tangent to the circle, as the line DC bisects the angle ADB, it bisects the line AB (which is a chord to the circle), and (by Theorem IV. Part II.) passes through the centre.

Hence a useful instrument may be constructed applicable to the centery of all circular work, but which, I think, is not in general use, though, some years ago, I constructed one for my own use, and it was much approved of by several workmen who

used it at that time. I shall, therefore, describe its construction, which is very simple, being but a T square, whose stock is a portion of a circle. Let ABC be the stock made of one piece of hard wood well seasoned, the extremities of which, at A and C, should have a small piece of hardened steel affixed so that it should not be subject to wear by use; into which stock the blade, BD, is tenanted, so that AB is exactly equal to BC, and at the same time perpendicular or square to the chord AC. It is evident that, from what has been advanced in the last Problem, if this instrument is applied to any circle so that the parts A and C touch it, the blade, BD, will pass through the centre of the circle, and, by two applications, the centre will be found.



It will be seen by the workman that two or three of these instruments will be necessary where stocks shall be of different curvatures, and blades of different lengths, to answer for different work.

I used to call this instrument my *centering square*, and shall only observe, that if I have described an instrument that is now in general use, I must crave your pardon for occupying your pages unnecessarily, and the mechanics' for their loss of time in reading that which they are already well acquainted with.

G. A. S.

(*To be continued.*)

MANUFACTURE OF GAS TUBES, ETC.

Mr. Russell, of Wednesbury, has acquired a deserved celebrity for his mode of manufacturing pipes and tubes of malleable iron. The following is his description of the process he employs:—He provides iron plates, previously rolled to a suitable thickness, and cut into strips of such length as may be found desirable to constitute one piece of pipe or tube, the breadth of the strip corresponding to the circumference of the tube intended to be formed.

The sides of the slips are then bent up by swages, or otherwise in the usual way, so as to bring the two edges as close together as possible.

This bent iron, or imperfect tube, is then introduced into a blast furnace, and, when brought nearly into a state of fusion, is removed and placed under a tilt hammer, for the purpose of welding the joint. The anvil, or the bolster fixed into the anvil, upon which the tube is to be placed, has a semicylindrical groove formed in it, and the under side of the hammer has a corresponding groove. The imperfect tube is now slowly passed along under the tilt hammer, and, by a succession of blows, the edges of the plate-iron become welded from end to end, and the tube rudely formed. The action of the tilt hammer is effected as usual; it vibrates upon pivots, and by the rotation of a wheel with projecting arms or cogs, which strike successively upon the end of the hammer, it is raised, and, falling by its own gravity, produces the repetition of blows.

When the edges of the iron have been thus completely welded from end to end, the tube is to be again heated in a furnace, as before, and

then passed through a pair of grooved rollers. These rollers may have several circular grooves suited to tubes of different diameters. The end of the tube, immediately as it comes out from between the rollers, is met by a conical or egg-shaped core, placed at the extremity of a stationary horizontal rod, which egg-shaped core enters the open end of the tube, as it advances from between the rollers, and by sliding upon this core the internal part or bore of the tube is formed to the exact diameter of the core, and rendered perfectly smooth, its external form being determined by the grooved rollers.

The advantages of this mode of manufacturing tubes and pipes of wrought iron, for conveying gas and other purposes, are, that the internal and external surfaces of the tubes are perfectly cylindrical and parallel to each other, and the irregularities occasionally arising from scales and other obstructions are altogether avoided.

SIR HUMPHRY DAVY'S COPPER SHEATHING.

At a Meeting of the Royal Society on the 13th inst., when it resumed its sittings after the Christmas holidays, the Learned President informed the Fellows, that the accounts which had appeared in the Papers, of the failure of his mode of protecting Ships' Bottoms, in the case of the Samarang, were wholly without foundation; and that the results were, on the contrary, of a most satisfactory description.

NEW WARLIKE MISSILE.

Sir,—I shall be happy to suggest, for the opinion of your readers, through the medium of your widely circulated Magazine, a plan for rendering more formidable our ships of war in close fight, and for protecting the walls of fortresses against the danger of scalade. Every one must be acquainted with the destructive nature of shells thrown from military engines, and the dreadful effect an explosion causes among the enemy. In close actions at sea they can scarcely be used at all, and, unless they explode the moment they reach the enemy's deck, they can be thrown overboard; and when thrown from the walls of fortresses, an enemy can generally avoid their effects by throwing himself upon the ground before an explosion takes place. Guns cannot be so pointed as to annoy an enemy much just under the walls; it is, therefore, desirable to invent some instrument of war to supply these defects, and I humbly conceive that the following drawing and description may not be uninteresting to your readers.

NAUTICUS.

Description.

B is a charged shell, of a pear form, fastened by its minor extremity to a handle of wood six or eight feet long. C is a tube full of holes inserted in the shell, and extending from one extremity to the other, charged with powder. D is a pow-

der on the percussion principle, fastened to its lower surface by any simple contrivance. When used, nothing more is wanted than to hurl it with precision to the spot wanted, either from the walls of a city, or the main-mast of a ship. It must fall by its own gravity on the point *d*, when it will instantly explode, and it would produce effects amongst the troops which may be more easily conceived than described.

LONDON IMPROVEMENTS.

Sir,—Having noticed, in one of your late Numbers, some observations on the Improvement of London, I am induced to offer, to the proper Authorities, some hints respecting one project that seems to tarry in the execution. An Act of Parliament has been obtained for the removal of Fleet Market, and I have never heard of any other step relating to it being adopted except the raising the requisite supply of money, viz. 130,000*l*. at three and a half per cent. A site of ground whereon to build the Workhouse belonging to the London Liberty of the Parish of St. Andrew, Holborn, and a proper spot for a burial-ground, in lieu of those to be removed from Shoe-lane, have been advertised for, but, as I believe, with very little success. The removal of the Market is but one step towards the long-projected scheme of an opening from Holborn Bridge into the great North road; but, instead of its being the first, I conceive it ought to be the last step.

In effecting most of the great improvements in London, too much money has usually been expended, by beginning at the wrong end. In the present instance, had a proper site been first inquired for, where to remove the Workhouse and burial-ground to, the offers of suitable situations might have pointed out that which it is my present purpose to submit. All the ground immediately behind the frontage at Holborn Bridge is covered with houses and buildings of little comparative value —survey Chick-lane and all its courts and alleys—look into Field-lane, but don't trust yourself to enter it; Great Saffron-hill, its lateral or cross streets, Red Lion-court, Caroline-court, and many such like places, are they not crowded with a population that is a terror to the city of London, and the more so as it is situated in the centre of it? Every day, and on the Sunday in particular, the occurrences supply cases of complaint at the office in Hatton-garden. Here is a most ample field for improvement both of the convenience and of the morals of the metropolis. Let all this extent of ground be cleared of its rubbish, viz. buildings and people, and there will be found the requisite convenience within, to remove the Workhouse and burial-ground, which now impede the execution of the measure the Legislature has sanctioned. I will further suggest that the ground to be cleared might supply sites for a Fleet Prison, for a Penitentiary or House of Correction, and other public buildings; all of which might be erected upon an unity of design that would conduce to the ornament of a thoroughfare through the metropolis, as well as to its convenience.

I am, Sir,
Your humble servant,
C. D.

INTERMITTING STREAM.

Sir,—As I consider your Magazine a vehicle of information in various branches of natural philosophy, as well as in that of mere practical mechanics, permit me, through this medium, to call the attention of your scientific readers to a phenomenon which periodically appears in the neighbourhood of Croydon, and which is now to be seen in its most interesting state. I allude to a stream that, at certain times, breaks from the side of a hill in Marden Park, not far from Godston, and which continues to flow for six or eight weeks, and then entirely disappears. It is a received opinion in the neighbourhood of this stream, that it flows only once in seven years; it has, however, flowed twice, and that too in great abundance, within the last five years, and is evidently dependent upon the quantity of rain that falls, and not upon any given period of time.

The rise of this stream is not the only peculiarity that belongs to it: its progress is equally singular, for it advances under ground till it has completely saturated the earth in its course, and may be seen boiling, or gently bubbling, from every pit and hollow, at a distance of a mile and a half or two miles in advance of the current that appears on the surface. The water is beautifully transparent, and of a bluish cast, very much resembling the sea at a distance from land.

Like other periodical springs, this is probably connected with some reservoir of water in the neighbouring hills, which, when filled to a certain extent, will continue to discharge itself through some passage resembling a syphon, till the whole or a certain part of it has escaped. When the water falls as low as the end of the passage immediately connected with the reservoir, it will then cease to flow till again replenished to the same extent by the rains sinking through the pores of the earth.

Having often had inquiries addressed to me concerning this periodical stream, you will, I hope, allow me, through your widely circulated Magazine, to inform those who feel at all interested in such a phenomenon, that it may now be seen within a mile of Croydon, and traced to its source in Marden Park. H.

Croydon, Jan. 10th, 1825.

DIAGRAM OF THE PRIMITIVE COLOURS; BY MR. CHARLES HAYTER.

Fig. 1.

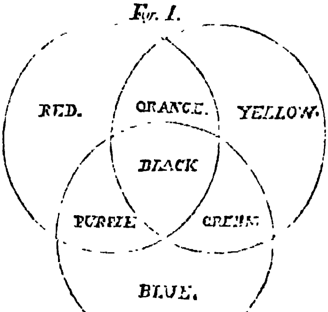
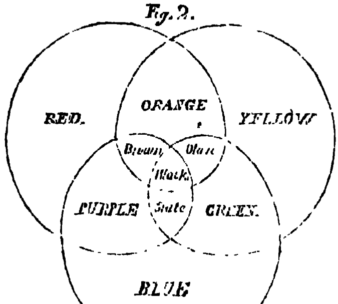


Fig. 2.



Sir,—In the year 1810, I invented *my* Equilateral Diagram of the three primitive Colours (see *Mechanics' Magazine*, p. 414, vol. II.), so composed as to produce the *seven* colours by the three *primitives* only, which I *lent* to the publisher of a small book on the art, as a part of a plate of diagrams which formed the frontispiece.

In 1813, I published my first edition on *Perspective* Drawing and Painting, wherein I introduced the above diagram, as it stands in the 14th plate of that work; when a gentleman, disputing my claim, brought me the *manuscript* of Harris's book on colours; which work, although in print, and dedicated to Sir Joshua Reynolds, I had never heard of; but, to my great satisfaction (for my book was *published*), I found Harris no forwarder than all others that I had or have seen on that point of illustration which should prove how the three primitives were

to be disposed, so as to give the seven colours thereby. Yet this I am bound in truth to say, that had Harris's two diagrams been like the one which I have (for ought *I know*) invented, I might have been silent on the subject without loss to *his readers*, for his letter-press is both clear and conclusive. But as soon as he has told us that the red, blue, and yellow, will produce green, orange, and purple, he gives us the first diagram of three equilateral triangles: here we see but the *three* colours and black; we are *informed* of the compounds which may be produced, and then a second diagram is given, *like* the first; but the tints introduced are green, orange, and purple, with a black centre, as before. These three, we are again informed, produce (by mixture of two together) *brown*, *olive*, and *slate* tints, which he explains by circumscribing his diagram with circles and subdivisions (according with my 4th diagram, plate XIV., first edition, for the Primitives), and passing the colours gradually round, out of one into the other, till, in each intermediate division between any two *principal* colours, the declared production is certainly found (if well coloured). This method certainly does show the practitioner how to make the tint he may require, but the root of the matter is not clearly displayed by his two *centre* diagrams.

This left me triumphantly easy with regard to the advance I had made, and I saw no further illustration necessary, otherwise I should not have repeated my *second* and *third* editions without an endeavour to attain it. Still Mr. Harris's "*brown*, *olive*, and *slate* tints," *appeared* to be wanting to make my *pet-invention* complete, which I am so fortunate as to have accomplished by the preceding Diagram, figure 2.

This diagram might be drawn at *one stroke of the pen*, if it could be guided perfectly.

Let it be understood that my *original* diagram still comprehends the whole that has been advanced by my ultimate scheme, if my third paragraph of Letter XVI. be received as a practical guide to using the colours on the 4th diagram of my plate on colours, in either edition.

I remain, Sir,
Your obedient servant,

C. H.

16, Buckingham-place,
Portland-road.

MECHANICAL DIFFICULTIES.

What is the cause of a piece of paper or wood remaining stationary when floating on the top of the water in a basin, when the basin is turned round? This, perhaps, may be considered a simple question, but the cause is unknown to the writer.

W. S. K.

SIR,—As I find by your very useful Magazine, that those like myself, who have but little opportunity or time for study or scientific pursuits, but whose callings stand greatly in need of both, derive much information from the subjects therein inserted, and are most liberally permitted to express their deficiencies, which others as kindly take the trouble of replying to, in which, in my humble opinion, consists much of the utility of your little, but very valuable miscellany, I request the favour of your allowing the following questions to appear, each of which has puzzled me exceedingly, without my being in the least capable of arriving at any satisfactory reason why it is so. I have looked into Chambers's Dictionary, and find no more than what my fellow-workmen told me before, and, like them, I take the matter of fact, as it answers in our trades; but I could wish much to know the causes: and I trust that some of your enlightened Correspondents will be so obliging as to furnish me and my brother mechanics with clearer notions respecting them that we at present possess.

1st, In one of your Magazines it is mentioned, that an additional pint of water will burst an iron-bound hogshead, if full, provided the pint be conducted in a tube which enters the hogshead to a sufficient height. This is no more than the truth, and

is a proof of the correctness of the law in hydrostatics, that the pressure of water on the bottom of a vessel is as the height of the water, but not as its bulk. I would wish to be informed how it is, that the water in a tube, of half an inch diameter and ten feet in height, is more powerful than one of three inches diameter and five feet in height, when it is clear that the one of greatest pressure contains many times less water than the other.

2nd, Every one knows, that one pound will balance twenty on the steelyard, and yet I cannot conceive why it should; attraction being, it is said, as the quantity of matter, and attraction, or be it gravity, being never suspended, but always acting. Distance on the arm, I know, makes the pea balance a greater weight on the other arm; but why distance should make the pea heavier, is what puzzles me to conceive.

3rd, Is it on the same principle that the longest leg of the syphon runs, or what pulls the water down one leg, and not the other? I have often strove to make the short leg run, but it would not; nor do I know the reason why the other should be more good-natured.

+ W X.

ANSWERS TO INQUIRIES.

NO. 70.—ARCHITECTURAL DRAWING.

SIR,—I think the following Instrument will answer the purpose of "Finical," mentioned in the 60th Number of your useful Magazine. It is an improvement on that described by Nicholson in the Carpenter's Guide.

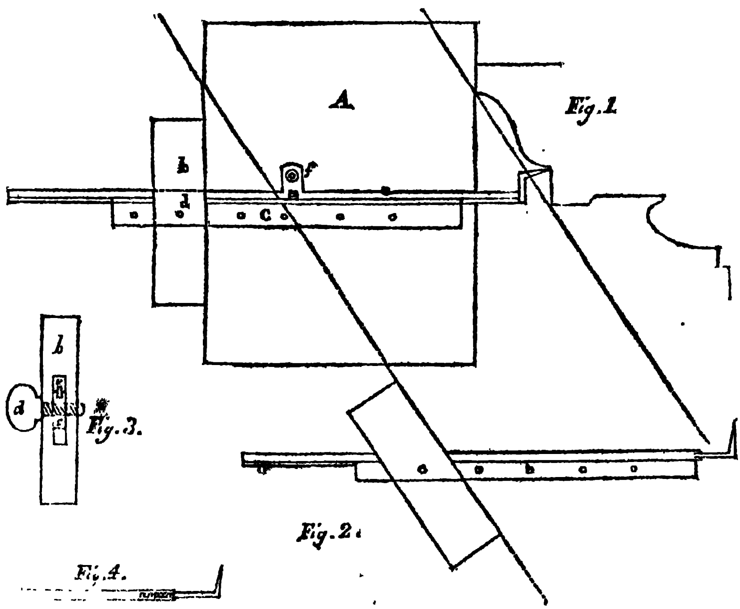


Fig. 1 exhibits a profile of moulding to be taken.

A is the board on which the moulding is to be described; it should be rather wider than the projection, with its edge perpendicular; but if more convenient, it may be placed as shown by the dotted lines (a sheet of paper may be put on the

board); *b*, the stock of the instrument morticed to receive the blade *c;* the mortice must be long, to admit of its being used, as fig. 2; *c*, the blade, with several holes to receive the thumb-screw, *d*, which secures the blade at a convenient distance and angle.

e, The slider of brass or iron, working in a dovetail groove (the point should be steel, and screwed into the end of the slider); *f*, a short tube, to receive a pencil screwed into the slider, in which are several screw holes to suit different distances, which must be greater than the projection of the moulding.

Fig. 3 shows the edge of the stock, with mortice for the blade; also the thumb-screw.

To take the sinking in the plunceer, the steel point must be unscrewed, and fig. 4 used in its stead.

I am, Sir, yours, &c.
Nov. 12th, 1824. A CARPENTER.

NO. 88.—DYEING IVORY SCARLET.

Make a ley of wood ashes, of which take two quarts; pour it in a pan upon a pound of Brazil wood; to this add two pounds of copper filings and one pound of alum: boil the whole half an hour, then take it off and let it stand; into this put the ivory, and the longer it continues in this liquor the redder it will be. The same process and dye will do for bone, and will make either of a fine coral red. A. B. C.

ANOTHER RECEIPT.

SIR,—In answer to your Correspondent's inquiry, No. 88, in Number 72 of the *Mechanics' Magazine*, I beg to hand you the following Receipt for Staining Ivory Scarlet, which I have used for many years with invariable success; and which, with slight alterations in the quantities of the substances employed, will produce on ivory all the different hues between the pale orange and the dark ruby or purple.

The ivory must first be highly polished in the usual way, with soap and water and powdered chalk, on a linen rag, and rubbed dry with a soft linen cloth.

To make the dye, take half an ounce of the best cochineal and two drams of cream of tartar, and a bit of alum about the size of a nut; grind the cochineal and alum to a moderately fine powder in a glass or Wedgewood mortar, mix the cream of tartar with them, and tie them up loosely in a piece of fine muslin; put this little bag into a common white basin, with a *large* pint of soft water, and immerse the basin in a saucepan, or other convenient vessel, full of water, so as to form a bath, and set it on the fire to boil; then steep the ivory for 30 or 40 seconds in dilute nitric acid, of such a strength as to be rather unpleasantly acid to the taste; wash it well for five or six minutes in clean water, stirring it all the time with a wooden spoon; then, with the spoon or a pair of wooden pliers, put it immediately into the basin containing the dye-liquor, taking particular care not to touch it with the fingers. As soon as the liquor becomes hot, the colour (which will now be a crimson or ruby colour) will strike into the ivory. To render this colour scarlet, have ready a saturated solution of tin in strong nitro-muriatic acid, which must be cautiously dropt into the dyeing liquor, until the colour becomes such as may be desired.* If too much of the solution of tin† be added, it will produce an orange, or almost yellow colour; but the scarlet or ruby hue may be again restored at pleasure, by adding a few drops of the carbonate of potash (salt of tartar of the shops) dissolved in water. When such a colour is obtained as may be wished, the work must be taken from the liquor with the spoon or pliers, and rolled up in a clean cloth until cold, to prevent splitting; when cold, it may be polished with a hard tooth-brush, next with a brush a lit-

* It is a good plan to keep a bit of fine scarlet cloth to compare your work with, in order to insure having a good colour.

† Any chemist will make the solution of tin in the nitro-muriatic acid; but it must be made with the strongest nitric, not nitrous acid, and it must be perfectly saturated.

tle softer, and the smallest possible quantity of sweet oil.

The best possible varnish for hard wood is a sort of French polish, sold by Messrs. Holtzapffel and Deyerlein, 64, Charing-cross, under the name of lacker for hard wood.

I am, Sir, yours, &c.

AN AMATEUR TURNER.

Norwich.

INQUIRIES.

NO. 89.—CHESS-MEN.

SIR,—Being about to make some Chess-men, and intending to cast them, I have been induced to solicit the favour of the admission of the following question in your widely extended Journal. I find brass will be too heavy for my purpose, but wish to know if any of your Correspondents be in possession of a recipe for making a composition resembling ivory, and what it is? and if so, what dye will stain it red and black?

I am, Sir,
Your obedient servant,
INQUISITOR.

NO. 90.—DEMAGNETISING STEEL.

What process is necessary to take from Steel its Magnetic power, without the application of heat?

J. S.

NO. 91.—CLEANING GOLD.

In cleaning up common Gold after soldering, we often find it of a very light colour (even better quality gold is the same). What is the best manner of cleaning (as, no doubt, it is the pickle which causes the effect) in order to restore it to its former deep colour?

J. S.

CORRESPONDENCE.

The inventor of the Cycloidal Chuck, described in our 72d Number, will please inquire at the Post-office, Stockton, for a letter (intended for him) addressed "C. C., Norton, near Stockton."

The letter of "A Young Mechanic" requires reconsideration. We shall decide upon it next week.

Communications received from—A. H. Rowan, Esq.—A. B. C.—Ignoramus—M. J.—W. S.—J. G. H.—C. H.—T. M. B.—T. Hartshorne—Jacob Morine—C. C. C. C.—An Engraver—A Lover of Good Things—A Stage Proprietor—A Constant Reader—C. D.—Stultus—A Constant Subscriber—Major.

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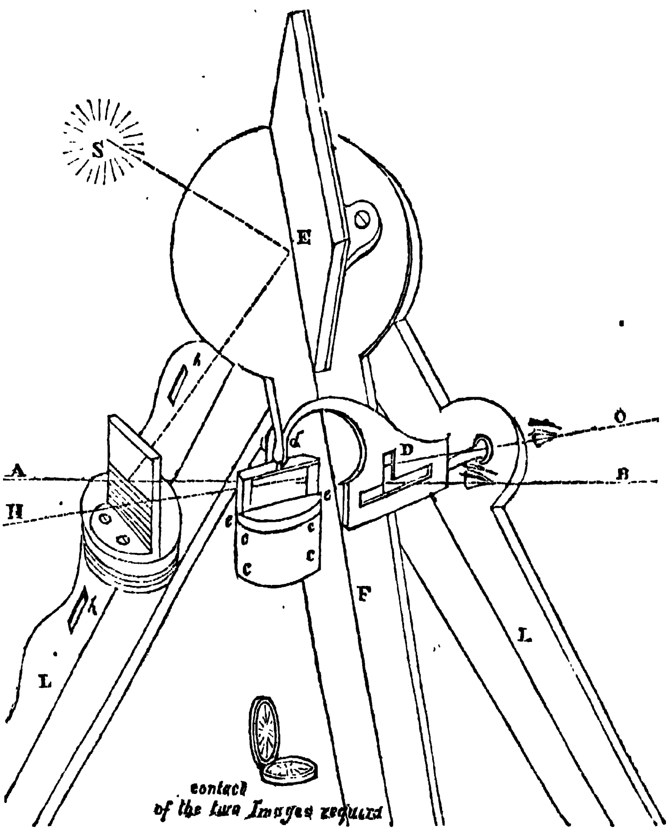
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 75.] SATURDAY, JANUARY 29, 1825. [Price 3d.

" *Knowledge* dwells
In heads replete with thoughts of other men;
Wisdom, in minds attentive to their own.
Knowledge, a rude unprofitable mass,
The mere materials with which Wisdom builds,
Till smooth'd, and squar'd, and fitted to its place,
Does but encumber whom it seems t' enrich.
Knowledge is proud, that he has learn'd so much;
Wisdom is humble, that he knows no more." *Cowper.*

IMPROVEMENT ON HADLEY'S QUADRANT.



IMPROVEMENT ON HADLEY'S QUADRANT.

Sir,—I have long wished to call the attention of your numerous readers to an attempt at an Improvement in Hadley's Quadrant. It consists of an additional glass, suspended from the sight vane in such a manner that the surface shall be in the line of sight directed from the vane to the centre of the horizon glass. The object to be gained by this is, that when the reflected image of the sun or other celestial body is brought nearly to the horizon, the image of such body is also seen in the suspended glass, and, as the index is moved forward, the two reflections appear to meet each other, and the instant they come into contact, you have only to read off the angle, which will be the altitude of the sun or moon's lower limb above the apparent or visible horizon.—The instrument was entrusted to me for examination; but I find that it is impossible to see the contact take place unless the eye be elevated a little above the true line of sight, a perpendicular slit being made in the sight vane for that purpose; this, of course, must give an erroneous result. If the eye be kept at the proper point, both images vanish before the contact can be observed, and this, in my opinion, is the great difficulty to be obviated. If any of your intelligent Correspondents can do this, I am certain every British seaman will gratefully acknowledge the obligation, as he will thereby be enabled to get the sun's altitude at a time when the true horizon cannot be depended on.

I have endeavoured, as well as I am able, to give you a sketch of the quadrant, with the improvement alluded to.

Description.

AB is the line of direct sight, or horizontal line, to which any celestial body must be reflected.

C, the surface of the additional glass, which is laid on the top of a brass cylinder, *cccc*, and unscrews at *ee*, whereby the glass is held tight at the points, *ii*, of the cross bar, by which it is suspended by a ring, *d*, which turns in the cross bar like a swivel. The glass is a piece dark-stained, for the sun; for the moon and stars, white; or, instead of stained glass, a piece painted black underneath, so that there may be but one reflection.

D, the sight vane, with the horizontal and perpendicular slit.

E, the speculum of the index reflecting the sun, S, into the horizon glass, G, and thence along the line of sight on the face of the suspended glass, C.

F, the index bar, which shows on the arch the sun's altitude.

LL, the limbs of the instrument.

hh, The holes for the shades, which are here omitted to prevent unnecessary confusion.

HO, the line of sight, when the eye is directed through the upper part of the perpendicular slit, when the image of the sun can be seen in the suspended glass, but not in the horizon glass, distinctly, as the lower limb is too low to observe the contact. When the eye is kept in the line, AB, the image can be distinctly seen in the horizon glass, but not in the suspended glass, as it is clear the surface of that glass makes no angle with the point of sight, being parallel thereto.

Should you consider this design worthy of a place in your Magazine, and any of your readers be induced to offer any remark upon it, they will render an essential service to seamen generally, and an assistance to the projector of the plan, who is a working mechanic.

I am, Sir,
Yours respectfully,
J. S.

STEAM NAVIGATION—COMPOSITION OF FORCES.

Sir,—It is astonishing how little interest the Problem proposed by E. S. C., page 381, vol. I. has excited, although, in my opinion, there has not been a question proposed, from the commencement of the Magazine to this date, of equal importance. I long expected that some of those gentlemen who entered so keenly into the discussion and merits of the grand arithmetical question, would have stepped forward with solutions, and not have resigned it into the hands of a humble mechanic. It appears from the experiments of Bossuet, in company with D'Alembert and Condorcet, who undertook a series of experiments on the resistance opposed to the motion of vessels in water, that the resistance is

as the square of the velocity. Several other philosophers, both on the Continent and in Britain, have come to the same conclusion; we may, therefore, consider the fact as established. From the law of the composition of forces, if any force propel a body through a given space in a given time, and if, then, another force equal to the first is made to act upon the body in the same right line, the velocity will be doubled. But this is only to be understood as applicable to bodies moving in an unresisting medium; therefore the resistance of fluids being as the square of the velocity, the velocity will be expressed by the square root of the sum of the squares of the given velocities: hence it is evident, if we put a = to the velocity communicated by steam, b = to that communicated by the wind, and v = to the compound velocity, we shall have $v = \sqrt{a^2 + b^2}$; which formula, applied to the present case, will give $v = \sqrt{6^2 + 6^2} = 6 \sqrt{2} = 8{\cdot}4852$. In the above solution the wind has been supposed a constant force; but that not being the case, a small deduction must be made on account of the increased velocity of the vessel. It may also be worthy of remark, that two forces acting in the same right line, in a fluid, produce the same effect that they would do if acting at right angles to each other in an unresisting medium. The above formula is equally applicable to the last part of F. H.'s inquiries, page 208, vol. III.

I am, Sir,

Your obedient servant,

D. SCREW.

Sheffield, Dec. 25th, 1824.

MR. BADNALL'S PATENT MACHINERY FOR THE MANUFACTURE OF ORGANZINE, ETC.

SIR,—In your Number of the 8th inst. I observed a few queries on the subject of my Patent Machinery for the Manufacture of Organzine, Sewing Silk, &c. I certainly should have made a point of replying to the said queries sooner, had it not unfortunately happened that my bookseller in town (who, by-the-bye, is in general a pretty regular sort of fellow) omitted sending me, until yesterday, the last and previous week's Numbers of your Magazine. I trust, however, this letter may be in time for publication on Saturday next, and that the following observations may be a sufficient answer to your Correspondent's questions:—

First—Will my patent machinery effect a saving of 30 per cent.?

Answer—*I guarantee it.*

Secondly—Is this true? and, if true, how is this to be effected?

Answer—I am most willing to show the said machinery at work to any person who may feel inclined to visit my factory, and I leave a conviction of the truth of what I have asserted to such person's judgment.

Thirdly—Is the silk so manufactured equal in quality to that which is made by the present machinery?

Answer—*Decidedly superior*, in consequence of the evenness and regularity of the twist which the thread receives, which *perfect* regularity, by no other known method, can be accomplished.

Now, Sir, in answering the above queries, I have been rather more laconic than I otherwise should have been, had your Correspondent thought proper to consult me on the subject previous to his bringing it forward in so public a manner; I have, therefore, addressed such answers to him alone. I can, however, have no objection to take advantage of the present occasion to make generally known the nature and extent of my improvements in the throwing of silk. By a reference to my specification, dated 18th March, 1823, a full and clear description of my inventions will be found. Since that period, however, I have been led to adopt (to the exclusion of the other plans) figures 6 and 7 only,* as being of themselves sufficient for accomplishing my object.

In the manufacture of organzine, according to the usual process, after the silk has been wound from the

* See drawings accompanying the specification.

hank or skein, *three operations* are necessary. The same are also necessary for the manufacture of sewing silk, after the silk has been wound and properly *sized* (what is generally called *doubled*), according to the strength or thickness of the thread required.

The first of these three operations is, to twist or spin the single thread of the silk intended for organzine on the combined threads of that intended for sewings—this is done by *one machine*.

The second operation is, to wind or double two or more, as circumstances require, of these twisted or spun threads together—this is done by a *second machine*.

The third operation is, to twist these threads together the contrary way to their original spin—this is done by a *third machine*.

The method I adopt entirely does away with two of these operations, and with the machinery and room which is necessary for their accomplishment. Each machine that I am now working is about six yards in length and one yard in width, containing 336 spindles, which are so arranged as to complete the manufacture of either organzine or sewing silk *at one operation*, or any other description of cord that may be wanted.

According to the observations I have made, it requires about twenty turns *per inch* for sewings of an average size, and from eight to twelve for organzine; therefore, if the spindles revolve, say 2000 times per minute (and I have now one mill working at the rate of 4000 times per minute), each spindle will throw off in that time 100 inches of sewing silk, or of organzine from 166 to 250 inches per minute. From this statement the length and the weight of silk that may be manufactured in a given time may be easily calculated.

In answer to your Correspondent's query as to my terms, &c.—they are, to receive, annually, one-third of the actual difference in the saving between this and the common method, decided upon and arranged at the time of the granting of the licence; the purchaser, of course, paying for the machinery.

My solicitors in town are, Messrs. Allsop, Parke, and Freeth, 63, Lincoln's Inn Fields, from whom all requisite information may be obtained; as also from my agent, Mr. Abbott, 14, Walbrook.

I am, Sir,
Your obedient servant,
RICHARD BADNALL, JUN.

Leek, 18th January, 1825.

I had almost overlooked the P.S. of your Correspondent, as to my machinery being adapted to the manufacture of silk for lace—there is no doubt of it; as to tram, read my specification.

SOME ACCOUNT OF THE LATE M. GUINAND, AND OF THE IMPORTANT DISCOVERY MADE BY HIM IN THE MANUFACTURE OF FLINT GLASS FOR LARGE TELESCOPES.

It has long been a desideratum among opticians and astronomers to obtain glass adapted to the manufacture of lenses of large dimensions for Telescopes. Notwithstanding the great labour and expense bestowed upon them, all experiments for that purpose had till recently proved fruitless. Within these few years, the obstacles which impeded its attainment have been surmounted, and lenses have been made of a perfectly homogeneous glass, without striæ, or any other defects, and to the extent of even eighteen inches in diameter. This improvement, which may be considered of great moment to science, as it will enable opticians to construct instruments of much higher power and more complete efficacy than those hitherto employed, and afford to astronomers a greatly extended range of observation, has been attributed by some persons to M. Frauenhofer, a celebrated optician of Bavaria. Feelings of justice, however, have induced a generous lover of science (who has favoured the public with the initials of his name only—C. P. d. B.) to publish a translation into English of a paper read, some time ago, before the Society of Physics and Natural History of Ge-

neva, which shows most satisfactorily that it is to the ingenuity and perseverance of a humble mechanic of Switzerland, of the name of Guinand, that we are really indebted for the accomplishment of this important object.

"Nearly seventy years," says the Memoir, "have elapsed since this interesting man, now on the verge of fourscore, and residing in a remote village among the mountains of Neufchatel in Switzerland, was employed in assisting his father as a joiner; and his present manner of reading and writing shew that he scarcely obtained the first rudiments of education. At the age of thirteen or fourteen he became a cabinet-maker, and occupied himself chiefly in making clock-cases.

"At this period he had become acquainted with a buckle-maker who lived in his neighbourhood, and of whom he learned the art of casting and working in various metals, which enabled him, about the age of twenty, after once witnessing the process, to attempt the construction of a watch-case; having succeeded, he adopted the occupation of a watch-case-maker, which was then very lucrative.

"Having constructed clock-cases for M. Jaquet Droz, he had an opportunity of seeing, at the house of that celebrated mechanist, a very fine English reflecting telescope, which appeared to him extremely curious and interesting. Those instruments were at that time very rare in Switzerland, especially among the mountains. M. Guinand was then in his twentieth or twenty-third year, and it cannot be doubted that this circumstance, in itself unimportant, first turned his mind towards that subject, to which, encouraged by success, he afterwards more particularly devoted himself.

"Be that as it may, M. Guinand having expressed a wish to be allowed to take to pieces this telescope, that he might examine it in detail, M. Jaquet Droz, who had noticed the dexterity of the young man, kindly gave him permission, and, with equal good-nature, relieved him from his apprehension of being unable to put it together again, by taking that task upon himself if it should prove too difficult for him. Thus encouraged, M. Guinand took the instrument to pieces; accurately measured the curves of the reflectors and glasses, and afterwards readily put it together; then availing himself of the few notions of metallurgy which he had gained from his friend the buckle-maker, as well as of the experience he had acquired in casting ornaments for clock-cases, he attempted the construction of a similar telescope; and his second experiment succeeded so well, that on a comparative trial of his own instrument with that which had been its model, in presence of a great number of persons, it was impossible to determine to which of them the preference was due.

"M. Jaquet Droz, surprised at this success, asked our artist what treatisé on optics he had followed as his guide; but he was still more surprised when the young man told him that he was not acquainted with any; he placed one in his hands, and it was not until this period that M. Guinand studied, or rather deciphered (for, as we have already observed, he reads with difficulty) the principles of that science.

"About the same time occurred another fortunate circumstance, in itself as trivial as the former. Having been always weak-sighted, he found, when he began to make watch-cases, that the spectacles, which had hitherto answered his purpose, were no longer of service; and being directed to a person whose glasses were said to have given great satisfaction, he obtained a pair which really suited him no better than the others; but by looking on while they were in progress, he learned the art of forming and polishing the lenses. He therefore undertook to make spectacles, not only for himself, but for various other persons, who pronounced them excellent. This new acquirement he found very useful in his favourite pursuit; and he amused himself in manufacturing great numbers of telescopes of an inferior quality, for which he made the tubes himself, generally of pasteboard. He also studied the small number of works he was able to procure, which treated on subjects connected with optics.

"Meanwhile, the ingenious and important discovery of achromatic glasses was beginning to spread; and having reached that country, it could not fail to be very interesting to M. Guinand, who listened with avidity to all that he heard on this subject. M. Jaquet Droz having procured one of these new glasses, permitted M. Guinand, as in the instance of the reflecting telescope, to take it to pieces, and to separate the lenses. It will readily be conceived, that the purpose of the latter was to attempt the construction of a similar instrument; but in this he was impeded by the difficulty of procuring glasses of different refractive power. It was not until some years afterwards that an acquaintance of his, M. Recordon, having proceeded to England, where he obtained a patent for his invention of self-winding watches, which were then in great request, brought him from that country some flint-glass; and though the specimen was much striated, he found means to manufacture from it some tolerably good achromatic glasses. Having obtained supplies of this material on various occasions, and having seen

other glasses besides those of M. Jaquet Droz, he easily ascertained that flint-glass, not extremely defective, is rarely to be met with. Thus convinced of the impossibility of procuring it of that quality which he ardently wished to obtain for the construction of his telescopes, and having by his various labours become sufficiently skilled in the art of fusion, he melted in his blast-furnace the fragments of this flint-glass; no satisfactory result was obtained, but he discovered from some particles of lead, which re-appeared during the process, that this metal was a constituent in the composition of flint-glass. At the time of this first experiment he had attained his thirty-fifth or thirty-sixth year. The ardent desire to obtain some of this glass then induced him to collect, from the different works he was able to procure, such notions of chemistry as might be useful to him in his attempts at vitrification; and during six or seven years (from 1784 to 1790) he employed a part of his evenings in different experiments, melting at each time in his blast-furnace three or four pounds of glass; he took care, in every experiment, to note down the substances and proportions of his combinations, the time of their fusion, and, as nearly as possible, the degree of heat to which he had subjected them; then, by an attentive examination of the results of his experiments, he endeavoured to discover the causes which had rendered his products defective, in order that he might obviate them on a subsequent trial. While occupied in these researches, he derived a strong incentive to perseverance, from the prizes which he understood to have been offered for this desideratum by different academies, and especially by the Royal Society of London, a copy of whose proposals was procured for him. At a later period he also learned, in a more positive manner, from the statements given in the first volume of the *Bibliothèque Britannique*, the almost total impossibility which existed of procuring flint-glass exempt from striæ; all this impressed him with the importance of the discovery at which he was aiming, and stimulated him in the pursuit. These experiments, however, made, as he observed, on too small a scale, all proved fruitless.

"At the age of forty and upwards, having relinquished the trade of watch-case-maker for that of maker of bells for repeaters, at that time very lucrative (since he could make as many as twenty-four in a day, for which he was paid five francs each), he resolved to prosecute his experiments on a more extended scale. Having purchased a piece of ground in a retired place on the banks of the river Doubs, near the Brenets, where his establishment is at present situated, he constructed, with his own hands, a furnace capable of melting at one time two hundred weight of glass, and settled there with his family on a very economical plan, in order to dedicate all his earnings and leisure to new and expensive experiments.

"His perseverance, however, had to overcome many untoward accidents, which would probably have deterred most persons from continuing the research. At one time his furnace, which he had not been able to construct with the requisite precautions, threatened to burst while heating, and he was obliged to rebuild it with materials procured from abroad; at another time it was not until after having employed several days, and consumed much wood in heating it, that he noticed an essential defect in its construction, which obliged him to suspend the melting. Sometimes his crucibles, which he had procured at great expense, or manufactured himself, cracked without his being able to discover the cause, and the vitreous matter escaped among the ashes, and was lost. After each of these trials he was obliged to employ a longer or a shorter interval in earning the means of subsistence, and of purchasing wood, and the necessary materials for his furnace, his crucibles, and his glass. These fruitless attempts discouraged him on some occasions, but on others excited him so as to deprive him of rest, and he meditated day and night on the probable causes of the accidents, and on the means of obviating them. At length, however, he obtained a block (*culot*) of glass, of about two hundred weight; having sawed this block vertically, he polished one of the sections, in order to examine what had taken place during fusion, and the following were the appearances:—On the upper surface of the vitreous matter there were many little semi-globules, which had the appearance of drops of water, terminating by a thread or little tube of greater or less depth, at the extremity of which there was a small spherical bulb. The cause of this appearance was, that these drops and tubes consisted of a denser kind of glass than the rest of the block. In another part there arose from the bottom of the crucible other cylinders, or tubes, terminating also in a kind of swelling or bulb; these had a hollow appearance, because they were formed of a substance less dense than the rest of the glass; and, lastly, here and there were seen specks, or grains, ending with a tail or train of a substance also less dense than the rest of the mass in which they floated; these, on account of their appearance, he denominated *comets*.

"The original cause of the non-homogeneity of strongly refractive glass being once ascertained, the question was, how to remedy it? and it was here in parti-

cular that M. Guinand had great obstacles to surmount.

"Here we would gladly relate the numerous experiments by which M. Guinand at length accomplished his grand discovery; but as it still serves to procure for him some compensation for his labours, we should be unworthy of the confidence he has reposed in us, were we to enter into any detail on this subject. We shall therefore only state, that after many expensive trials, M. Guinand having been so fortunate as to obtain glass of which some parts were perfectly homogeneous, and therefore destitute of those striæ, or threads, from which flint-glass is so rarely found free, he reflected on the different circumstances which in this experiment might have contributed to so happy a result, so that in subsequent attempts he obtained blocks of glass possessing larger portions of homogeneous substance, and at length he has almost arrived at a certainty of obtaining, in the fusion of from two to four hundred weight of glass, at least one-half of that substance perfectly homogeneous, and consequently fit for optical purposes.

"Unable to make any further progress, he admits that his processes have not yet attained all the perfection which might perhaps be desired; but as he has by these means succeeded in making disks, perfectly homogeneous, of twelve, and in one instance even of eighteen inches in diameter, and having no doubt that, in operating on a greater scale, he might easily be able to obtain one of a diameter double or triple the extent of those last-mentioned, he justly concludes that his process has at length removed the obstacle which the non-homogeneity of flint-glass opposed to the construction of large achromatic object-glasses.

"Guinand having become acquainted with Captain Grouner, of Berne, an intendant of the mines, the latter had occasion in Bavaria to speak of his improvements; and a short time afterwards, in 1804, he asked him, on the part of M. Frauenhofer, the chief of the celebrated establishment of Benedictbeurn, for some specimens of his glass. The letter of M. Grouner at once testifies the high esteem he had conceived for M. Guinand, and his earnest wish that his discovery might be rendered useful. M. Frauenhofer, after examining these specimens, and requesting several disks of the glass, was so well satisfied with them as to repair in person to Brenets, a distance of about 260 miles, where he engaged M. Guinand to take a journey into Bavaria. Having arrived in 1805, he determined to settle there; and during a residence of nine years he was almost solely occupied in the manufacture of glass. It is from this period that M. Frauenhofer's achromatic telescopes have acquired so well-merited a reputation.

"Among the telescopes made by M. Guinand, there are several of remarkable magnitude and effect; in general, the greater part appear to advantage on comparison with English telescopes; a merit which is owing, in an especial manner, to the quality of the glass. But the most singular circumstance attending them is, that they have been constructed by an old man upwards of seventy, who himself manufactures the flint and crown glass which he uses in their construction, after having made with his own hands his vitrefying furnace and his crucibles; who, without any mathematical knowledge, devises a graphic method of ascertaining the proportion of the curves that must be given to the lenses, afterwards works and polishes them by means peculiar to himself, and, lastly, constructs all the parts of the different mountings, either with joints or on stands, melts and turns the plates, solders the tubes, prepares the wood, and compounds the varnish."

[Here follows a long and detailed explanation of the original process pursued by M. Guinand for giving the required curve to his lenses; but as the mode adopted in this country appears to be superior, that detail is omitted. When the Memoir from which we have made the preceding extracts was addressed to the Society of Geneva, M. Guinand was still living; but the intelligence of his decease (at the close of 1823) was communicated at the same time with the history of his labours.—EDIT.]

GUNN'S PATENT WHEEL CARRIAGES.

SIR,—Among a circle of friends I have heard much stated concerning the improvements on Wheeled Carriages, for which Mr. Gunn has lately obtained a patent, and the prevention of robbery was spoken of with great confidence. Now, as nothing on the subject has hitherto been laid before the public, may I request the favour of you to insert this in your valuable and most useful Magazine? Should it meet the eye of the patentee, I would beg leave to suggest the propriety of his publishing a description of the improvements, particularly if applicable to public carriages.

I am, Sir,
Your obedient servant,
A STAGE-PROPRIETOR.

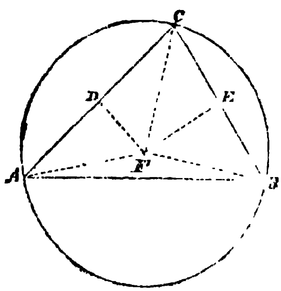
MECHANICAL GEOMETRY.—No. VII.

(Continued from Page 281.)

PROBLEM XI.

About a given triangle to describe or draw a circle.

Let ABC be the triangle; we are required to draw a circle round it that shall pass through the angular points A, B, and C. Bisect AC in D, and draw DF perpendicular to AC; also bisect, in like manner, CB in E, and draw EF perpendicular to CB, then the intersection of the lines DF and EF is the centre of the circle, and AF, CF, and BF, are all equal to each other; therefore (by Definit. I. Part II.), with either of these lines as radius, describe the circle from the centre, F, and the Problem is performed.

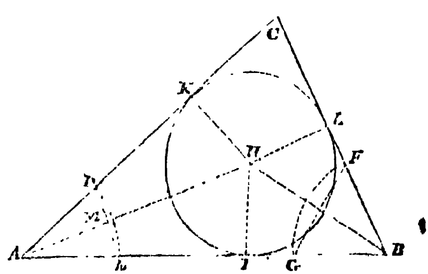


Note.—The reader will perceive that this Problem is but an application of what was shown in Problem IX. Part II. for the points A, B, and C, are, by the conditions of the Problem, supposed to be in the circumference of a circle

PROBLEM XII.

Within any triangle to inscribe or draw a circle that shall touch each of its sides without cutting them.

Let ABC be the triangle within which we are required to draw the circle, IKL.



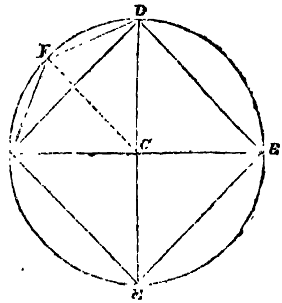
With A, as a centre, and with any radius, as AD, describe the arc, DE, and draw the chord, DE, which bisect or divide into two equal parts, as at M (by Problem VII. Part II.), and through that point draw a line from A, as AH, extended towards the side, BC, of the triangle; in the same manner draw the arc, FG, from B, and bisect it. Draw BH towards the side, AC, then will the intersection of AH and BH be the centre of the circle; then from H draw HI perpendicular to AB (by Problem III. Part III.), then is HI the radius of the circle which will touch all the

sides, that is, HI, HK, and HL, are all equal to each other.

PROBLEM XIII.

Within a given circle to inscribe a square.

Let ABDE be the given circle; draw any diameter, as AB, and perpendicular to that diameter draw another diameter, DE; join AD, DB, BE, and EA, and it is done.



Note.—This Problem, though so very simple, is not only of extensive application to every mechanic, but furnishes the means of describing any polygon in a circle whose number of sides is divisable by four; thus, if we wish to describe an octagon, after first describing the square, as above, bisect any of the sides, as AD; then, drawing CF perpendicular to AD, and joining AF, it will be the side of the octagon, as was required; also, if we again bisect AE in like manner, we shall have the side of a polygon of sixteen sides, and so on continually. G. A. S.

(*To be continued.*)

INCREASING THE EXPANSIBILITY OF POWDER.

Sir,—In answer to a question proposed by your worthy Correspondent "F. H." published in the 69th Number of the Mechanics' Magazine, I have the following observations to make, which I shall be much obliged by your inserting. His words are—"I should wish to ask the opinion of some one more conversant with the properties of air than myself, whether, if a body of closely condensed air were allowed suddenly to exert its whole force, in *expansion*, on a quantity of gunpowder in a confined situation, it would not answer the *same end!*" (namely, the explosion of gunpowder.) To this I should certainly answer, No. His own statement, at the beginning, goes against it; for, in order to obtain air in a sufficiently condensed state to cause a *sudden* explosion, it is necessary to subject it to a great pressure. Now, if that pressure be sudden, he himself tells us caloric is evolved; consequently the re-expansion of the air will be productive of *cold.*—Again, to chemists it is well known that, if the pressure be applied slowly, caloric will be disengaged exactly in the same manner as in the former case, though, perhaps, not *sensibly*; the result, therefore, will be similar, and cold will be generated. I have further to observe, that the air, even in the state of condensation, will be of a higher temperature than when expanded; for it is a well-known fact that air loses its caloric by being rarefied, else, whence the cause of water freezing under the almost exhausted receiver of an air-pump? or whence the cause of the decrease of temperature as we ascend in the atmosphere? Upon this hypothesis your Correspondent's second question requires no answer.

I am, Sir, yours, &c.

Edinburgh. C. M. A.

BRICKS.

Sir,—In Number 33 of your valuable depository of scientific intelligence, Mr. Elmes has given a portion of an outline of the important and

necessary art of Brickmaking, but which, to many of your readers unacquainted with that art, is almost useless, merely giving some names and colours of particular bricks. I hope Mr. Elmes, or some other of your Correspondents, will clear up, for the information of your numerous readers, the following *desiderata*, namely—

Whence the colour of bricks?—That it is not solely iron, is proved proved by many or all of the same mass being parti-coloured; being white where they are supposed to touch others in the kiln, and red in the remaining parts of the same brick.

The art of making the pale yellow may, of course, be done by mixing chalk, and dirt, and ordure, as is done in the vicinity of London: these are only for show, not compactness.

Can bricks be made with clay alone, without any mixture whatever but sand to separate them from each other in the kiln, and to clear the moulding frames?

How is the pug-mill made? I find no description of it in the Encyclopaedias.

And, above all things, what is the cause of the *porous* and *dense* bricks?—The former are sometimes so light and brittle as to break with their own weight, and suck up water like a sponge; the latter are often so hard as to bear hammering on like an anvil, without breaking, and at the same time so close-grained that they resist water like marble.

What is the cause of this, and how is this excellent quality of durability or density obtained?—Of the porosity we would only know how to avoid it.

Also, how is the glazing of bricks performed?—Some think it is done with salt alone, others that they are partially vitrefied by the heat of the kiln alone. The cheapest way of glazing would be an advantage to be known, whatever it may be.

The above are some of the principal parts of the knowledge of brickmaking, which, if Mr. Elmes will be kind enough to explain, or any other of your Correspondents, he will oblige many of your readers, particularly one in the centre of England, who is

Bolnhurst. A RUSTIC.

N. B.—There is a white glaze, as in stone-ware blacking-bottles, and another of a blue or slate colour, much used by the Dutch—how are these obtained?

EVAPORATION.

SIR,—I observe, in your Magazine, Number 73, page 260, an abstract of observations on Evaporation, by Dr. Bostock. Having made observations, in Bedfordshire, on the quantity of evaporation for several years, and seen the result of similar observations in other places, and finding Dr. Bostock's quantity fall so much short of the average of other places, I presume there is something very particular in the situation of the Doctor's vessel, or some mistake in the deductions. My vessels were always exposed to the free action of the air, but screened from the direct action of the sun. The quantity evaporated in the summer months sometimes amounted to five inches per month, whereas the monthly quantities, deduced from the hourly quantities in the above-mentioned table, will not amount to one inch; and the total, for the eleven months given, to about six inches, instead of twenty-four, as found in this and other parts of the country.

Yours, &c.

B. BEVAN.

MECHANICAL POWERS OF MAN.

SIR,—The Mechanical Powers of Man cannot fail to be an object of importance, more particularly in a country expanding in every branch of useful knowledge. The powers and laws of most of the visible bodies in the universe have been investigated with great accuracy by men of science, but few have taken the pains to investigate and ascertain the mechanical powers of man. It is true we find, in some of our best practical works on Mechanics, the result of a few experiments on the powers of man to carry burdens, and to draw a load horizontally and upon

planes nearly horizontal, and also to raise a load by means of a windlass. But there are many other modes of applying the strength of man which deserve notice, such as in the act of rowing a boat, lifting a dead weight, using an auger, a gimblet, a screw-driver, a bench and hand-vice, &c. &c.; most of which may be determined with sufficient accuracy for general purposes, by many of your readers, if they were to register the results of a few observations often in their power to make. By way of inviting communications of this kind in your useful Magazine, I beg leave to offer a list, as a specimen, to be corrected from time to time, as may be found necessary, premising that many ordinary operations are performed in a short space of time, and may therefore be done by greater exertion than if a longer time was necessary. Thus a person, for a short time, is able to use a tool or instrument called

	Lbs.
A drawing-knife, with a force of...	100
An auger, with two hands.........	100
A screw-driver, one hand.........	84
A common bench vice handle......	72
A chisel and awl, vertical pressure	72
A windlass, handle revolving......	60
Pincers and pliers, compression....	60
A hand-plane, horizontally........	50
A hand or thumb vice.............	45
A hand-saw......................	36
A stock-bit, revolving............	16
Small screw-drivers, or twisting by the thumb and fore-finger only...	14

At another time I may, probably, send you a few cases to exemplify the use of the above list,

Remaining, yours truly,
B. BEVAN.

WEIGHTS AND MEASURES.

SIR,—Having never turned my thoughts on the subject of Measures and Weights, I may seem bold in troubling you with the ideas of a novice, and more so in presuming to offer them for public reading. If my error should amount to blameable, I may fairly place some of it to your account, through the very interesting contents which awaken intellect in a regular flow of instructions and suggestions in your Mechanics' Magazine, which I read with much pleasure and advantage, being at a period of life when one's rudimental learning requires a refreshing replenish.

In your 73rd Number, Mr. T. H. Pasley has engaged my thoughts by his learned suggestions on the necessity of finding "an unerring standard for measure," and has, like a true philosopher, invited investigation and information with evident desire for the perfection of the matter on which he has advanced his opinions. This sincerity of mind, when stedfastly engaged for the benefit of mankind, must ensure some advantage, and most likely advance towards the object sought. Were the ignorant to wait till the learned might think fit to make their knowledge public, the multitude might remain in darkness.

The free inquiry which you cherish in your publication, *calls forth* the required information, and increases the general illumination of the mind, invigorating society by the sublime power of knowledge. Several questions have been put which have brought forth much information by the "ingenious" considerations and the decisive answers of many who, most likely, would never have volunteered their knowledge on the subjects of such questions. These salutary evidences of general advantage are so clear, that they cannot fail to excite sentiments of satisfaction in every votary to arts and sciences. It is for *such reasons* I am drawn into a digressive vein of remark on the benefits which the Mechanics' Magazine offers or *affords* to an inquiring public.

Now, with regard to the proposition of T. H. Pasley, who agrees that no *undeviating standard has been* (nor probably can be) *found*, I, for want of better judgment on the subject, offer my opinion in favour of the nearest standard that has yet been determined on, which, after all, must be allowed no better name than "*a conventional standard*," which is the *best height* of a man, namely, six feet. If such man be well proportioned, he would also measure six feet exactly, on the utmost extent of

both arms, from his two longest fingers ends—*this* gives the *fathom*. In one of the same just proportion, twelve inches make his foot, and *such man's full step*, as well as half his height—one yard. If these can be admitted as the *best* standard to be found for lineal measure, I am not learned enough to doubt the utility of the mathematical subdivisions of such standard, or the multiplying longer standards by the simple whole of either "*fathom*, *yard*, or *foot*." Why the rod, pole, or perch, should not arise from such standard, instead of introducing the "*half*-foot," I am not qualified to question or answer, but have thought that it had better have been feet, yards, or fathoms, in *whole* numbers.

As for weights and solid measure, for liquids, I dare not advance even a question on them; but, at the instant of writing, I propose the weight of a well-proportioned man to be divided into 72 parts, as one to each inch of his height, and make the weight of one part and its subdivisions to answer *all* retail purposes, in lieu of the *present* pound weight; and all larger weights in whole numbers of 6, 12, 36, and 72 parts of the original standard; and why all solid measures might not arise out of the arithmetical operations of long measure, on the length, width, thickness, or other dimensions of solids, I know not. But, if you urge the learned to advance their knowledge on the subject, by laying this before them in your valuable Magazine, the results may, as heretofore, prove the utility of inquiring.

Yours respectfully,

C. H.

16, Buckingham-street, P. R.

IRON TRADE.

It was with surprise, and we confess with some doubt as to the correctness of the statement, that we read, in *Trewman's Flying Post*, the extraordinary advance that has taken place on Iron; and, notwithstanding the caution and great respectability of that journal, we were disposed to consider they laboured under some erroneous information; and so we should have considered at this time, had we not been assured, by a gentleman on whose veracity we can place the utmost reliance, that in stating "Bars, which some time since met a dull sale at 7*l.* per ton, can now scarcely be obtained for 13*l.*, while pig iron has even exceeded this, being now more than one hundred and twenty-one per cent. beyond what it was a short time since," they were correct.

That this article, in times like the present, when the demands of the Ordnance and the Navy are, for the present, unknown, should experience such a rise, is, to many, matter of astonishment; but, we conceive, a little reflection will easily account for what perhaps is not within the records of history to parallel, and will likewise continue, if not to the extreme of the prices now quoted, at least very near them.

The legitimate effects of peace are now beginning to be enjoyed throughout a large part of the civilized world, and the children of genius, enterprise, and industry, are calling into action those powers for which our country stands unrivalled. To give full effect to this, a great demand is necessarily made for this most valuable of all metals, as not any improvement of much importance can be effected without receiving its important aid.

Two rail-roads alone, now contemplated to be eligible for trading and commercial purposes, one from London to Edinburgh, and the other from Birmingham to Liverpool, with the necessary carriages for the conveyance of goods on them, will, we are informed by a Correspondent, require little, if any thing, less than two hundred thousand tons!!

This, with a commerce extending now in every direction, with every possible encouragement, calls on the manufacturer to supply what must be produced by the inventive ingenuity of the mechanic, who, in his turn, to carry into effect the plan he has contemplated, must apply to the mine for this soul of his invention; and when we consider that those efforts, however boundless and colossal they may be in extent, are not, as in other countries, cramped and shackled for want of means to bring them to maturity, as the countless millions of our capitalists are ever ready to support any measure that carries with it the least probability of a moderate reward for the sum invested in the speculation; this encouragement, too, instead of decreasing, has a contrary effect every year, from the decreasing value of money in our public funds, which stimulates its tens of thousands to activity and usefulness, which the maddening influence of war had rendered hardened and indifferent to every valuable pursuit.

Those are a few of the reasons which induce us to conclude that iron will continue to maintain high prices.—*The Devonshire Freeholder.*

THE ARCHIMEDEAN MIRROR A GENERATOR OF STEAM.

When a thermometer is exposed to the solar ray reflected from a plane glass mirror, the mercury rises *two-thirds* of the height it would attain if exposed to the sun's direct ray. Three mirrors are equal to a *two suns' power*. When the sun, or his reflected image, acts upon a thermometer, it becomes stationary after some time; because, though the source of heat is constant, all farther increase is impeded by radiation, contact, and the agitation of the air. The thermometer or other object to be heated should therefore be enclosed within a cover or screen of planished tin, or other material provided with a metallic surface, and the solar ray transmitted through a pane of glass, which will remain uninjured by the passage of heat, if chosen thin and transparent. Over this cover, if a second and a third concentric cover be placed at the distance of half an inch, the *accumulation* of heat may be so augmented that *a solar ray will boil water*.

In the Encyclopædia it is stated, that "the action of a vertical sun through a thin capsule of glass might heat up a dark horizontal surface 113 degrees, by Fahrenheit's scale. This effect is far inferior to what we have repeatedly obtained. Adopting, however, this very moderate element of calculation, we shall find that, at the temperature of 62 degrees two mirrors boil water, eight melt lead, and the *patent solar reflector*, composed of 99 six-inch *specula*, being *a sixty-six suns' power*, will communicate 7458 degrees of heat to a surface of a quarter-foot, or 466 degrees, over an area of four feet. Twenty such reflectors, that might be constructed for 100*l*., afford nearly 150,000 degrees of heat, *a power far superior to any ever before at the disposal of man*.

The means we have adopted for preventing the *dispersion* of heat, will preserve heat, when accumulated, several days or weeks, enabling us to operate by night as well as by day.

The solar reflector may be employed as a locomotive power on iron rail-roads, in navigation, in ploughing, harrowing, and other agricultural labours; in working mines, heating public and private buildings, &c. &c. without smoke or noxious effluvia. Its burning energy at great distances having been already experimented by others, I shall not dwell upon, but conclude by observing, that the *solar reflector* will be found an equally useful auxiliary to the *chemist* in his laboratory, as to the *mechanic* in his workshop.

I am, Sir, yours, &c.

W. CORBET.

23, Dover-street.

IRON COLONADES.

SIR,—When first I addressed you, in order to show that Mr. Wedderburgh's plan of the Iron Colonade was not original, I promised that, at some future day, I would lay down part of the many inconveniences which, if ever his plan were adopted, would arise therefrom. I will now, in as concise a manner as I am able, point out what I believe every reasonable man will allow to be insuperable objections to such an "iron scheme."

Mr. W. seems to build his hopes of public patronage on the vast utility of his scheme, in conveying water and gas pipes, on its being a substitute for sun-shades in protecting the passenger from sun and rain, and on the wonderful grandeur it will give to the streets.

With respect to the water and gas pipes, he has not shown *where* the utility lies; indeed, it would be a difficult task, inasmuch as it is evident that the old plan is superior on this account only—that though the pedestrian may not be disturbed in his passage along the streets (which, however, I much doubt), the inhabitants of the houses will have the workmen on the tops of the colonade repairing the pipes, and thus intruding on their privacy in an awkward and disagreeable manner. The complexity which would attend the conveying pipes along his pillaring colonade would, besides, be considerable.

Now, as to the sun-shade benefit, we all know that shades are only necessary during a part of the day; and so readily are they used in pulling out and winding up, that this grand consideration seems of the least importance. Again, some shops do not require shades, and in some particular parts they are not wanted

The proposed colonade would also go to destroy the variety of handsome shop-fronts which at present adorn the streets of London, and exhibit the arts and manufactures of Great Britain, and, in-

deed, of the whole world, in the highest perfection.

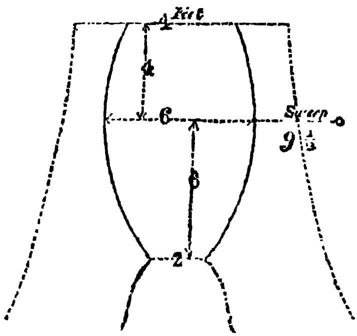
Considering, farther, the facilities it would afford to housebreakers and pickpockets—the closeness it would occasion by confining the air, and numerous other petty inconveniences, I believe this Utopian scheme of an iron colonade, to shut out the rain which cleanses the streets, to exclude the sun which affords light and genial heat, would be utterly abandoned by all men, excepting such as are as visionary in their dreams as your worthy Correspondent, Mr. Wedderburgh.

I remain, your obedient servant,

ANTI-COLONADE.

ANSWERS TO INQUIRIES.

NO. 78.—LIME BURNING.



SIR,—In reply to your Correspondent S. F. respecting the construction of a Kiln for burning Lime with turf and other light fuel, I send him, through the medium of your most useful work, the form and dimensions of the most approved kilns used in the north of Ireland for this purpose. I must observe, that the turf dug from the bogs in Ireland is much more solid and durable, as fuel, than any English turf I ever saw: one car load, probably about five cwt. will burn twenty bushels of lime of the finest quality, the stone being very hard and compact, and of that species found in primitive mountains, of gneiss and mica slate, some of which is perfect marble, and most of it making a near approach to that state. The stone is broken so small, that no piece is left more than about one inch thick; thus the carbonic acid gas of this compact stone has only to be driven off by the heat of the fire from a depth within each piece of half an inch. As it requires one-third, by measure of coal, to convert any quantity of limestone into lime, and as a bushel of coal weighs about 83lbs., it appears that nearly the same weight of turf as of coal is required to burn lime; and hence your Correspondent will probably find, that a similar *weight* of the combustibles he enumerates will be necessary for this purpose. To economise heat, the Irish kiln is kept constantly burning, by supplying peat and limestone in due proportion at the top, as the mass sinks down, and the lime is taken out below. The very light materials S. F. enumerates may probably, without some care, burn away too rapidly to produce the proper effect. I cannot give him any positive information on this point. I would suggest, however, that as the combustion may be totally extinguished by cutting off the supply of air at the bottom of the kiln, the heat may surely be regulated by the partial admission of it. If this should be found upon trial to

act partially and irregularly, perhaps balls made up with loam and heathy sward beat up together may answer. I conceive S. F.'s kiln should be constructed, externally, of what he calls limestone-grit, and lined with bricks set in brickmakers' loam. The whole ought not to cost more than 15*l.*

Brompton. C. C.

NO. 69.—STRENGTH OF ROPE.

SIR,—The following is a rule (in answer to T. S., Number 69, p. 207) for judging the weight which a Rope will bear. Multiply the circumference in inches by itself, and take the fifth part of the product, which will express the tons it will carry. Thus if a rope has six inches circumference, 6 times 6 = 36 ÷ 5, which is $7\frac{1}{5}$ tons. Apply this to a rope of $3\frac{1}{5}$, on which Sir C. Knowles made his experiment: $3\frac{1}{5} \times 3\frac{1}{5} = 10\ 5\frac{1}{5}$, which is 2.05 tons—4928 lbs.

It is established, that tarred cordage is weaker than white, and the difference increases by keeping.

The following experiments were made by Mons. Du Hamel, at Rochfort, on cordage of 3-inch French circumference, made of the best Riga hemp, August 8th, 1741.

	White.	Tarred.
Broke with strain of	4500 pounds	3400 pounds.
	4000	3300
	4800	3258
	August 25th, 1743.	
	4600	3500
	5000	3400
	5000	3400
	September 23rd, 1746.	
	3880	3000
	4000	2700
	4200	2800

A parcel of white and tarred cordage was taken out of a quantity which had been made February 12, 1746. It was laid up in the magazine, and comparisons were made from time to time, as—

	White bore	Tarred bore	Difference.
1746 April 14th	2645	2312	333
1747 May 18th	2762	2155	607
1747 October 21st	2710	2050	660
1748 June 19th	2575	1752	823
1748 October 2nd	2425	1837	588
1749 Sept. 25th	2917	1865	1062

M. Du Hamel says, that it is decided by experience, that white cordage, in continued service, is one-third more durable than tarred; secondly, it retains its force much longer while kept in store; thirdly, it resists the ordinary injuries of the weather one-fourth longer.

We know one remarkable fact, that in 1758 the shrouds and stays of the shear hulk at Portsmouth Dockyard were overhauled; and when the worming and the service were taken off, they were found to be of white cordage. On examining the Store-keeper's books, they were found to have been formerly the shrouds of the Royal William, of 100 guns, built 1716. She was thought top-heavy and unfit for sea, and unrigged, and her stores laid up. Some few years afterwards her shrouds and stays were fitted in the shear hulk, where they remained in constant and very hard service for about thirty years, while every tarred rope has been repeatedly renewed.

The shrouds were tarred and blacked, and not known to be white rope; therefore it appears, that white rope, tarred and blacked, will resist the weather, and be much stronger.

These remarks I find in my private book, made when Master on

board his Majesty's ship Impregnable, of 100 guns, in 1815, but from where copied I cannot remember. As she was then employed in the Mediterranean, I think it likely the paper may have fallen in my observation there.

I am, Sir,
Your obedient servant,
WILLIAM AMEY,
Master, Royal Navy.

INQUIRIES.

NO. 92.—SPIRITOUS LIQUORS.

SIR,—I should be much obliged to any of your Correspondents, if they would furnish me with information on all or any of the following questions:—

By what ingredients and by what process may an impure spirit be so rectified, as to be deprived entirely of its smell, and of all taste except that of a spiritous and fiery nature?

From which of the three following ingredients—molasses, raw sugar, or refined, may the purest spirit be obtained, and in what comparative proportions from each?

And in what kind of vessel, open or covered, in what degree of heat, and during what time, should any of these be left in fermentation before they are fit to be committed to the still?

AN INQUIRER.

N.B.—All the directions I could derive from printed channels on this subject I have tried, and they have all failed.

NO. 93.—PAINTER'S DIFFICULTIES.

What is the best method to ensure success in colouring old paperhanging, so that the figure shall not strike through the new colour, as sometimes it will do, without paint or plain paper being first applied? Also to ensure success in colouring or whitening cielings that are stained from various causes, through the floors, roofs, &c.?

NO. 94.—DETERIORATION OF STEAM BOILERS.

SIR,—I am in the habit of working Steam Boilers, and consume the smoke upon a certain principle, whereof the leading feature is to prevent the smoke going up the chimney (at least in a great degree), by nearly closing the damper; the heat under the boilers and in the flues consequently annihilates a great part of the smoke. On opening the flues, I lately found the outside of the boiler, in the flue part, scale off, and betwixt the scales and the sound part of the plates the colour is vermilion red. I should feel much obliged to any of your intelligent Correspondents to explain the cause of the above phenomenon, and to point out such remedy as may prevent this evil.

I am, Sir, &c.
A SUBSCRIBER.

Warrington.

CORRESPONDENCE.

Junius Anaxarchus, "On the more general adoption of Iron, and the impolicy of advancing its Price," is a better patriot than logician. *Policy* has nothing to do with the price of this or any other commodity; and the more general the adoption of iron becomes, the more likely it is to rise in price. He is right in contending that *one* native iron mine is "preferable, in every moral and political sense, to a score of Transatlantic gold and silver mines." As we must decline the insertion of his paper at length, it is left for him, as desired, at our Publishers'.

S. O. To his first question, *Yes.* To his second, *Probably.*

Communications received from—A Constant Reader—T. M. B.—C. S. B.—Keysoe—Aurum—C. Eagland—Ball—Rustic—A Subscriber—Another "Subscriber" at Warrington—Robert Murphy—A Cottage Proprietor—J. Merryweather—Circumflex—B. B.— x Z.—Juvenis.

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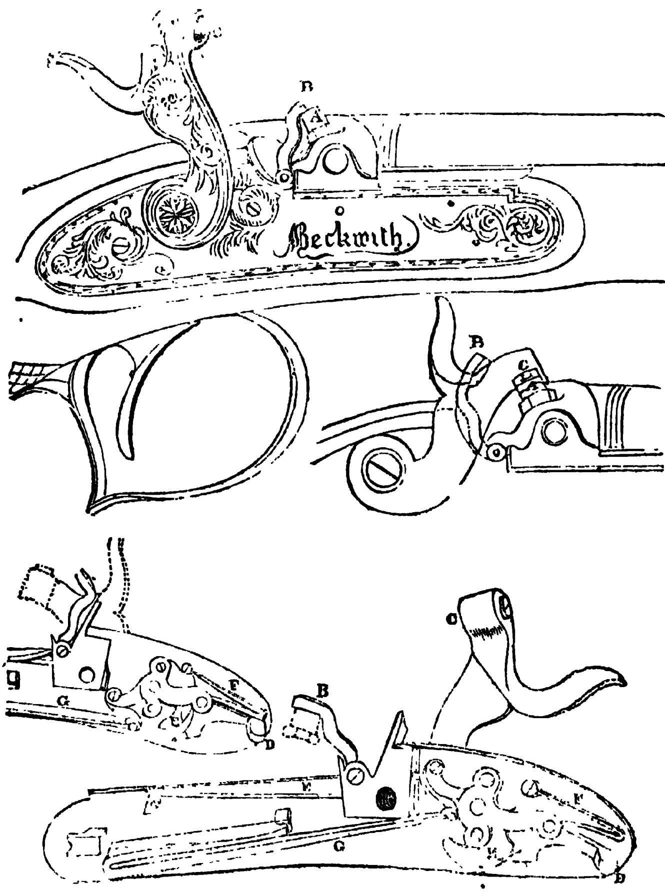
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 76.] SATURDAY, FEBRUARY 5, 1825. [Price 3d.

" Ingenious Art, with her expressive face,
Steps forth to fashion and refine the race,
Not only fills Necessity's demand,
But overcharges her capacious hand.
Capricious Taste itself can crave no more
Than she supplies from her abounding store;
She strikes out all that Luxury can ask,
And gains new vigour from her endless task." *Cowper.*

BECKWITH'S PERCUSSION GUN.



BECKWITH'S PERCUSSION GUN.

SIR,—I feel sorry that Mr. Wightman should imagine, for a moment, that I have or had *any desire or intention to injure him.* I give him full credit for the ingenuity of his improvement, but it must be allowed that there are others who are equally entitled to commendation for their exertions.

I am not interested in the sale of guns, whether of Mr. Beckwith, Mr. Wightman, or any other maker, or in their manufacture, or of any article whatever relating to them. I speak of them from use. I have used a rifle upon Forsyth's principle, with magazine; I have also used fowling-pieces made by other persons, and by country makers of Lincolnshire and Hampshire; but I have not met with any one whose make has given my friends or myself the satisfaction that Mr. Beckwith's has; and *this I say without his knowledge*, and without intending to enhance the sale of one man's goods to the prejudice of another, as Mr. Wightman would imply I do in my observations on the Century of Inventions.

The risk attending a lock with a magazine is, that the powder in the magazine may ignite and cause an accident. In the rifle I used there was a small piece of cork introduced into a vent-hole in the magazine; so that, should the powder in the magazine ignite, the force of the explosion might be spent upon the cork, and prevent danger ensuing.

The lock Mr. Wightman mentions as Mr. Beckwith's, with *a magazine sliding on a bar*, is not the lock I allude to. The lock I mean has *no magazine*, and is upon the most simple construction. It has a hammer, through the top of which a screw passes; into the breech a small cup or a nipple is screwed (it is perforated so as to communicate the fire to the powder in the chamber); this cup or nipple does not project from the side, but rises in the front of the breech, whereby cross action is avoided. If the sportsman is inclined to use a copper cap, with percussion powder in it, the nipple is put into the breech, and a short screw is put into the hammer. If, however, no caps are to be got, and the sportsman has some percussion powder, or wishes to use it instead of a cap (which powder is m[illegible] convenient for use when made [illegible] a small pellet or ball, the size of a large pin's head), then the nipple is taken out and the cup screwed into the breech in its place, and a longer screw put into the hammer to reach the pellet in the cup; and to prevent the pellet falling out of the cup, or the copper cap from coming off the nipple, as the hammer is drawn up from the cup or nipple after loading, a small cap falls down and covers the cup, so that no wet can touch the priming, which cap rises up and makes way for the hammer when the trigger is pulled.

To prove the rapidity with which the hammer falls upon the cup, put a pellet of percussion powder into it, draw the hammer to full cock, and the cap will cover the cup; turn the gun over, that the mouth of the cup shall point to the ground; when the gun is held in this position, and the trigger pulled, before the ball can fall out of the cup the hammer strikes it.

With respect to the recoil of a gun, as mentioned in the latter part of Mr. Wightman's letter, I do not recommend a gun *overloaded* as a pleasant thing to hold to one's shoulder; but this I know, and have proved myself, that sometimes the powder in the chamber of the gun will be damp, or clog from some cause or other, and the copper cap or pellet will not communicate its fire. In that case I have unscrewed the nipple, and introduced a small quantity of dry powder into it and the chamber, and have screwed the nipple back to its place, and put on a fresh cap: the gun has then gone off *without recoil*, and as if no such stoppage had occurred—*this*, I say, is a great advantage, and *this* was my advice; and the risk of bursting the piece, by such an act, is next to nothing. But the fact is, I perceive, that Mr. Wightman has beeen speaking of one sort of lock, which has been used by Mr. Beckwith, and I am speaking of another as now used by him.

I trust that this description, though wanting in technicality of expression, may be understood; but, that the proof may be made, and the fact speak for itself, I have sent you my gun, which was made by Mr. Beckwith two years back, and, after an inspection of it, you can yourself decide as to the simplicity or complexity of the lock, and its power.

By the gun being in your possession, you will be enabled, if it meets your approbation, to make such a drawing from it as will render the above description more intelligible to your readers, and the gun may remain in your charge for one week from the day on which this letter may be inserted in your Magazine, to satisfy any person whose curiosity may tempt him to call and see it.

I am, Sir,
Your obedient servant,
S. R.

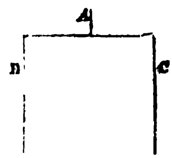
London, December 1st, 1824.

[We have prefixed to this communication a side-view and sections of the LOCK of the Gun, with the inspection of which we have been kindly favoured by S. R., and which may be seen by any of our readers, at 55, Paternoster-row, during the ensuing week. The *letters* denote the corresponding parts in the different views.—ED.]

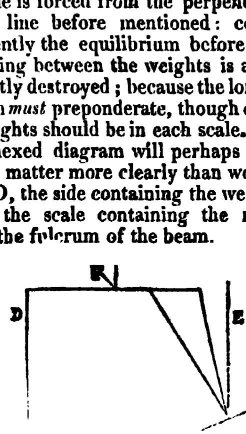
THE BALANCE.

SIR,—I had written a few hasty thoughts to you, explanatory of *my* view of the "singular property of the Balance," in answer to G. B., p. 234, under the impression that he was mistaken in his explanation thereof (this was on the evening of the 1st of January); but being in company the following evening with two persons who have had much experience in the construction of very delicate balances, men of considerable mechanical talent and information, the conversation turned upon G. B.'s explanation, and conceiving it to be erroneous, I endeavoured to explain my theory as intelligibly as I could, but was not fortunate enough to convince my auditors of its propriety. Fearing I had been betrayed into error, for want of duly considering the subject, I determined to put my proposed solution to the test of experiment, as the surest way of ascertaining the truth or error of my position.

The solution which I proposed was as follows:—The man being counterbalanced by the weight in the opposite scale, the pressure of the weight in each scale on the centres of suspension will be in the direction of two perpendicular lines (*i. e.* one at each point of suspension) at right angles with each end of a horizontal right line joining the points of suspension, and forming three sides of a square, if I may be allowed the expression, as A B C. Now, when



the man presses upward against the beam, he exerts an equal pressure against the scale on which he stands, forcing *it obliquely outwards* from the *fulcrum* of the beam, thus effectually *elongating that arm* of the beam with which he is now identified. The balance becomes one of unequal arms between the fulcrum and centres of suspension, in proportion as the scale is forced from the perpendicular line before mentioned: consequently the equilibrium before subsisting between the weights is apparently destroyed; because the longest arm *must* preponderate, though equal weights should be in each scale. The annexed diagram will perhaps show the matter more clearly than words:—D, the side containing the weight; E, the scale containing the man; F, the fulcrum of the beam.



I have since then tried the experiment with a piece of wood, contriving

it so that it should attach firmly to the beam, in imitation of the man's grasp, which keeps him firm in his situation. The same effect follows—the scale on *that* side descends.

Under these circumstances, I offer the above explanatory observations to the consideration of your readers. If they are founded on truth, and prove correct, I shall feel pleasure in having contributed my mite to the mass of useful information contained in your valuable work; if in error, I shall feel equal pleasure in seeing that error *properly* pointed out. I say *properly*, because, in my opinion, a supercilious air of superior wisdom, venting itself in mere assertion, or, what is worse, in ridicule, where sound reasoning *only* ought to be employed, may *wound the feelings* of an opponent who *means well*, but cannot prove beneficial, and may prove injurious to science and to the cause of truth.

I am, Sir, yours respectfully,

C. Eagland.

10, Poland-street.

Sir,—I am induced to take up my pen, in consequence of some observations of S. Y. on my opinions of the property of the Balance, mentioned by C. D. On looking over my letter, I find a mistake, which I take the present opportunity of rectifying. Where I said, that in order to produce the effect stated, the pressure should be applied between the pivot (or centre of motion of the beam) and the point of suspension of the scale wherein the man stands; the passage should stand thus:—"In order to produce this effect, the pressure must be applied between the point of suspension of the man's scale, and the opposite end of the beam; for it is plain, that a pressure applied at or beyond the pivot would have a proportionally greater effect, could it be conveniently applied."

Thus I beg to correct what I assure you was an unintentional error, but, at the same time, my ideas on the subject remain unchanged; and I still consider the cause I before stated, viz. leverage, to be correct.

Your Correspondent W. L.'s idea agrees with mine; but his wording has a slight inaccuracy, where he says, "the pressure applied to any other part of the beam than the point of suspension will cause a preponderation to the man's scale; for if the pressure be applied beyond the point of suspension ever so little, it will (in an accurate balance) cause a preponderation of the other scale."

I can, perhaps, anticipate S. Y.'s intended solution, viz. that it is caused by the swinging of the scale; but it is sufficient to say, that the swinging cannot alter the point of suspension.

I must confess I am at a loss to know where I have fallen into those faults of style, of which S. Y. accuses me in so intemperate a manner. But as I have already run to some length, I will not stop to attempt a vindication of,

Sir, yours respectfully,

G. B.

Rotherhithe-street, Jan. 27th, 1825.

RAILWAYS AND UNIVERSAL STANDARD.

Sir,—The doubt expressed by your Correspondent, G. W. p. 269 is a very natural one to a novice in the theoretical principles of mechanical science, and to most of our practical men it is a perfect stumbling-block; but the position advanced in that excellent article on Railways, is strictly consistent with the principles of dynamics, or laws of motion. G. W., I have no doubt, is acquainted with the principle or law of bodies falling freely by the force of gravity; and since *up* and *down* are only relative terms, if he asks himself the following inquiry, he will perceive the truth of what is at present to him a matter of doubt. Why may not the same principle exist in all bodies when acted upon by an uniform force, greater or less than that of gravity, and in any direction whatever? The mathematical sciences are universal in their causes and effects. The same law which whirls and rolls those stupendous orbs in the unbounded abyss of space, is equally applicable to the

motion of the pebble when projected from the hand—to the ship in the rapid or convex surface of the ocean, and the waggon upon the level or inclined plane.

Mr. Pasley's suggestion of a universal standard for our weights and measures, is founded upon the same principles; but I do not agree with him in thinking, that the distance which a body falls in a second of time, would be more accurate than the lengths of the pendulum vibrating seconds at any proposed latitude. Certes, the point of suspension of the pendulum can be as accurately determined as the point from whence any body falls by the free action of gravity. The experiments of Galileo (who is justly and universally allowed to be the father of this branch of physical science), and subsequent researches of Huyghens, have shown that falling bodies and vibrating pendulums are variable at different latitudes, and they have also shown that this variation arises from the peculiar figure of the earth; so that before we attempt to discover a true standard from the theory of falling bodies, the figure of the earth ought to be the first object of our inquiry. But here we are not left without a witness. The labours of Maupertuis and others have determined it so far as almost to bid defiance to farther human ingenuity on the subject.

I am, Sir,
Your obedient servant,
J. Y.

63½, Red Lion-street, Clerkenwell.

PUBLIC READING-ROOMS AND LIBRARIES.

Sir,—I am one among many of your readers situated in the interior of the country, at a distance from any library, and have at different times to go to London on business, where I may occasionally prolong my stay to a considerable extent. I have a great desire to read several books I see advertised as published, and to consult others; and I have often been told, that in London I may read all, and see every thing of that nature; but in this I have been so greatly mistaken, that I must beg the favour of you, or any of your Correspondents, to inform me where there is any public Reading-room where strangers may be admitted, on paying their fee each time entering the door, or otherwise to go and call for any work, and sit there and read it as long as they please, or call for others to refer to, while there, as convenient. This request being complied with, will, I am certain, benefit many of your readers, and, indeed, all situated as I am, who have been greatly disappointed in their expectations hitherto.

I have been referred to many places; some I have found private rooms at booksellers, appropriated to their customers or friendly visitors, and where strangers have nothing to do; others I found to be book-clubs, where, by periodical subscriptions of the members, a library was formed, of course for their exclusive use, and near their residence, of which a stranger could neither be a member nor visitor. Others, again, were circulating libraries, where I found not one work I wished to read or refer to, being mostly novels, old histories, voyages and travels, of every date but the latest; others were small lending libraries of magazines; and some few, very few, possessed late popular works, but nothing scientific. Thus, Mr. Editor, in all I have been disappointed; and though you may perhaps think it incredible, the following is fact:—I wished to refer to a patent detailed somewhere in the Repertory of Arts in the year 1801 or 1802, and though I have made fourteen journeys to London since, with constant attempts to refer to that work each time, I have been always unsuccessful. I begin to think there is no such place as I am seeking, although some continue their assertions in the affirmative; but if not, the sooner it is known the better, and if happily the contrary, I hope you will point it out.

I have observed advertisements lately of several books published, of travels in, and descriptions of, a country I particularly wish to be acquainted with; but at many libraries I have called at, I find they rarely have them till some years after they come out.

The advantages of a reading-room are numerous—I need only mention one. I see advertised a work I particularly want; I go to a bookseller's—I call for it—it is produced; I may look at the titlepage, the print or type, the plates, if any, and the number of pages; to ask to read a chapter would be unreasonable—I may purchase it, or refuse. On purchasing it, I take it home, and perceive by the first chapter that it is merely a puff-book, or what is termed a catchpenny. Thus deceived, it is laid by, not worth sixpence, for waste paper; and sorry I am to say, this is frequently the case: but it answers the end of the writer, who, having contrived a specious titlepage, has entrapped

many. Now, by reading a chapter or a few pages of any work at a reading-room, I see the nature of it; if a poor one, I continue to peruse, and if a good one, I purchase a copy.

I am, Sir, yours, &c.

Jan. 12th, 1825. KEYSOE.

[We know of no establishment in the metropolis such as our Correspondent inquires for. The want of it is greatly to be lamented. There is scarcely a provincial town of any note which is not better provided with Public Libraries and Reading Rooms than London.]

ROPE BRIDGES.

In India there are bridges called Portable Rustic Rope Bridges of Tension and Suspension, and they are exactly what the name describes. A few hackeries will carry the whole materials, and the appearance of the bridge is rustic and picturesque. They are distinctly bridges of tension and suspension, having no support whatever between the extreme points of suspension, independent of the standard piles, which are placed about fifteen feet from the banks of the nullah, or river, except what they derive from the tension, which is obtained by means of purchases applied to a most ingenious combination of tarred coir ropes of various sizes, lessening as they approach the centre. These form the foundation for the pathway, and are overlaid with a light split bamboo frame-work. The whole of this part of the fabric is a fine specimen of ingenuity and mathematical application. One great advantage it possesses is, that if by any accident one of the ropes should break, it might be replaced in a quarter of an hour without any injury to the bridge. It is impossible, in this article, to give so particular a description as to render its minute parts clear, nor, in fact, can any description do so, unaccompanied by the plan.

The chief principle of its construction is the perpendicular action of its weight; a principle obviously of paramount necessity in India, where the soil is so loose, and offers so little resistance, and more particularly in relation to the specific purpose for which they were invented. The whole weight of the bridge, therefore, resting on two single points, so far separated, and unassisted either by pier-head or abutment, rendered its construction a matter of extreme delicacy, and it has been effected in a manner reflecting the highest credit on the genius of the inventor. The combination of lightness with security, and the adaptation, to the utmost nicety, of the required proportionate strength to the parts, form its chief characteristics. The tension power is wholly independent of the suspension.

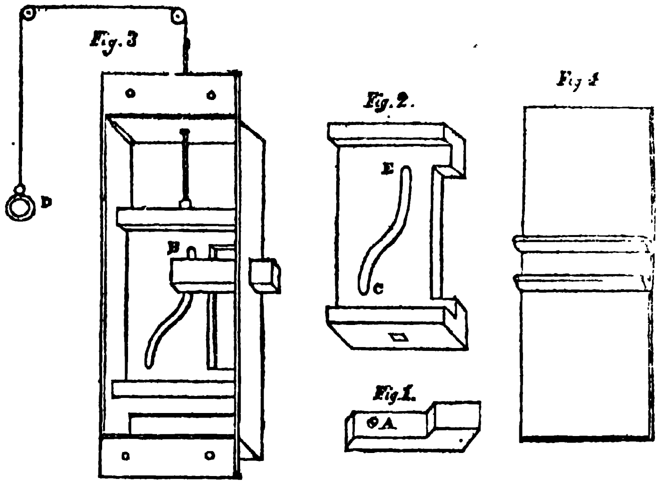
The bridge which was placed during the last rains over the Berai torrent, was 160 feet between the points of suspension, with a roadway of nine feet, and was opened for unrestricted use, excepting heavy-loaded carts. The mails and banghees passed regularly over it, and were by its means forwarded when they would otherwise have been detained for several days. The last rainy season was the most severe within the last fifty years, and yet the bridge not only continued serviceable throughout, but, on taking it to pieces, it was found in a perfect state of repair. The bridge intended for the Caramnassa is 320 feet span between the points of suspension, with a clear width of eight feet. It is in other respects the same as the Berai torrent bridge. A six-pounder passes over with ease; six horsemen also passed over together, and at a round pace, with perfect safety.

BEER COCKS.

SIR,—You may have observed Beer Cocks constructed for the purpose of admitting air at the very time the beer is drawn, so as to do away with the necessity of using a vent-peg. They are ingenious in theory, I admit, but in practice are found very deficient. Let a glass, of appropriate size, be fitted to a small cock on this plan, and filled with water; it will be found that the air which is allowed to enter by the cock creates a ferment in the water, so that the beer is drawn quite thick

Yours, &c. H. F.

WOLLASTON'S PATENT NIGHT-BOLT.



SIR,—Many of your readers, who value their own security and comfort, will be glad to become acquainted with a Night-Bolt (for which Mr. Wollaston, of No. 1, Great St. Helen's, has a patent), which is greatly preferable to that in common use; not liable to be out of order, applicable to any door, and which may be fastened or unfastened at pleasure, by means of the pull alone, without any previous operation. We send you a drawing and description of it, and are

Your obedient servants,
THOS. BAILY & Co.

No. 30, Cornhill, Oct. 1824.

Description.

Fig. 1 represents the bolt or tongue, on which may be seen a pin, A, by which it is to be moved horizontally forwards or backwards.

Fig. 2 represents a weight, with an oblique groove, BC, in which the pin, A, of the bolt, slides, so as to move the bolt outwards or inwards, according to the position of the weight.

Fig. 3 shows the case in which the bolt and weight are contained, laid open from the back, for the purpose of letting them be seen in their proper situations.

D is a counterpoise to the weight, which may be raised or depressed at pleasure.

Fig. 4 is the cover of the case, having attached to it two small bars to guide the motion of the bolt.

OPTICAL EXERCISES.

SIR,—I was amusing some friends a few evenings since with optical experiments, which gave pleasure to all, and each seemed perfectly satisfied with the explanations I delivered; being certain that he who can operate and lecture must be best informed, and most assuredly right. The invisible shilling, made visible by pouring water into the bason which contained it, was well received; and the terms refraction and reflection, made use of in the illustration, were considered mighty explanatory. Coloured shadows were new, surveyed with delight, and passed off without the slightest remark on any thing I said, although it took me considerable time in demonstrating the numerous points connected with the formation of coloured light; such as refrangibility, fits of easy transmission, affections of light, reflection; and the coloured image of a dissected eye, in which I proved how the fact takes place, of the image of the butcher and his axe being seen on the back of the aqueous humour of a bullock's eye, upon dissection, immediately after the beast has been killed. I next exhibited the phenomenon of a multitude of images

of a single lighted candle, situated between two plane mirrors, at which some of my friends were as enthusiastically delighted, as when Galen first contemplated a human skeleton. Here I felt myself perfectly at home; and, as I lectured on the reflecting powers of bodies, the velocity of light, and angles of incidence and reflection, I enjoyed as much happiness at perceiving the conviction expressed on every countenance, as a Brahmin at the assenting groan of his hearers, when they receive the spirituality he distributes among them so profusely. Can you conceive, Sir, any thing more enviable than were my feelings? Alas! they were soon depressed. The son of one of my friends came forward to perform the experiment, and then asked me how the light from the candle, which is spread equally over the entire surface of each of the mirrors, could collect into separate images on the glass? I told him it was occasioned by the opposite mirror reflecting them back again. He wished to know what the glass did to throw them back? Here his father called him troublesome, and protested that boys, now-a-days, assumed to themselves more knowledge of things than men formerly. "But," continued he, "I do not so much wonder at it, learning is now so cheap, and so generally *diffused* among the rising generation." Here again the lad said, "Reflection could not be the cause of the picture of the candle on the glass, because every person saw the same image on a different part of the glass; and if there were as many images as the spectators pointed to, even with a single mirror only being used, some one would possibly see more than one image, and some two persons would see the image on the same part of the glass." These remarks were got over by a little adroitness on my part, as nothing is more unpleasant than being obliged to enter into discussions in the highest sciences to convince those who have got but a mere smattering in philosophy. "Because, Sir," continued the urchin, "I can make as many images appear at once with a single mirror as you can with two." "The thing is impossible," I said. "Oh no, Sir, it is possible—look here." So placing the candle about three inches from the mirror, and near one end of it, he made me look at the glass from the other, at an angle of about 15 degrees, when, to my very great surprise, and no small mortification, I saw as many images as by the two mirrors. "Where now, Sir," he cried, "is your reflection?" I could only answer, "The case being new and unexpected, I would consider of it." The boy has a right, it must be allowed, to know a good deal, for he reads all the *Mechanics' Magazines*. As we meet again this day month, will you be good enough to obtain for me some new, yet fashionable elucidation of this unexpected case.

I am, Sir, yours, &c.

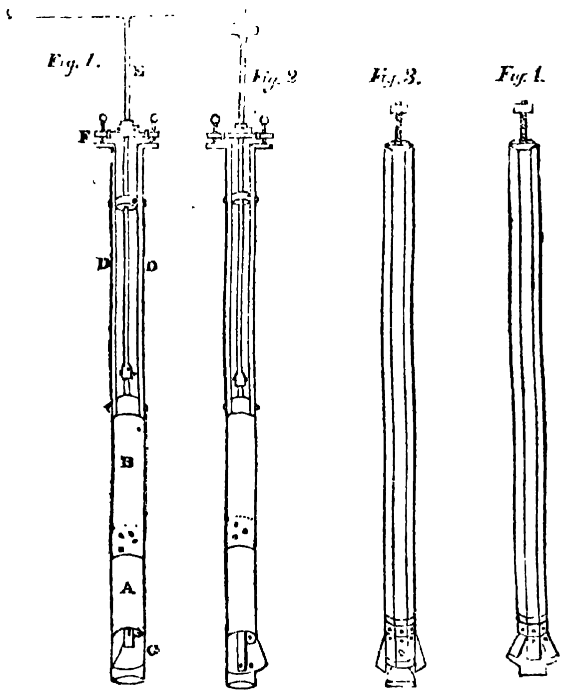
OBEDNEGO.

LOCOMOTIVE STEAM-ENGINES.

A grand experiment was recently made as to the power of Locomotive Engines at Killingworth Colliery, near Newcastle-upon-Tyne, in presence of several gentlemen from the Committees of the intended Manchester and Liverpool, and Birmingham and Liverpool Rail-road Companies, when the result was as follows:—The engine being one of eight-horse power, and weighing, with the tender (containing water and coals), five tons and ten hundred weight, was placed on a portion of rail-road, the inclination of which, in one mile and a quarter, was stated by the proprietor (Mr. Wood) to be one inch in a chain, or one part in 792: twelve waggons were placed on the rail-road, each containing two tons and between 13 and 14 hundred weight of coals, making a total useful weight of 32 tons and 8 cwt. The twelve waggons were drawn one mile and a quarter each way, making two miles and a half in the whole, in forty minutes, or at the rate of three miles and three quarters in an hour, consuming four pecks and a half of coals. Eight waggons were then drawn the same distance in thirty-six minutes, consuming four pecks of coals; and six waggons were drawn

over the same ground in thirty-two minutes, consuming five pecks of coals. The engine, it appears, must be supplied with hot or boi ling, and not with cold water; and 200 gallons of water will take the engine fourteen miles, at the end of which the supply must be renewed.

BORING MACHINERY.



SIR,—Having invented an apparatus which has proved of essential service, and which is likely to be very beneficial where it can be used, I doubt not you will be happy to give it a place in your valuable work, the *Mechanics' Magazine.*

The object of the invention is the fastening of a bolt, five, ten, or twenty feet below the surface of the earth. Chalk, or a soft stone that can be easily bored, are the best adapted soils for this purpose. The trial has been made by me, in chalk, in keeping down the floor of a dry dock, which floor is of timber, and had been raised by the upward pressure of the water, and been aying in a hopeless state ever since 1819, having baffled th skill of some of the first engineers the country produced. The floor is 130 feet long, and 32 feet wide; and by introducing two rows of bolts, twelve and fourteen feet long, and four feet apart, the floor is kept down secure, and the dock is one of the driest in England.

The pressure I put on one of the bolts, for a trial, was forty tons, which made no impression on it whatever.

The following is a description of the Bolts, as well as of the Drill, and the method of using them:—

First, with an auger is bored a hole five inches in diameter, and the depth of the bolt.

A and B, in figure 1, is a cylinder five inches diameter, in two parts; A being fitted into B, with a turned six-inch boring, having three grooves to receive the ends of three screws passing through B, as represented by three dots. These screws keep the cylinder from separating, and at the same time admit A to turn round freely, leaving B stationary.

DD are two flat bars of iron screwed into B, with their upper ends at right angles. These returned ends serve as a guage to regulate the length of the drill, and also having holes in them, they can be nailed down, and prevent B from turning round with A.

E is a round bar of iron passing through the cylinders, the lower end of which is square, having, in the lower part of A, a collar or square hole to pass through, by which means A is turned.

C is a knife or cutter, hung by a pin at the top, which the bar E, coming at the back, forces out, as the handle is turned round, and the soil is drilled away.

F is a regulator; one part, a brass collar screwed on the bar, E, running round in the cross-piece, F, through each end of which is a screw. This regulator is to prevent the bar from going down too fast, and by turning the screws the drill frees itself, and is easily let down, until it forces out the cutter to the stopper, as it appears in figure 2, when it can go no farther.

Figure 3 is an iron bolt, fourteen feet long, and two inches diameter, with a nut and screw at the top, and a dovetailed head, five inches diameter and five inches long. This bolt is cased with four pieces of fir, one inch and a half thick, and made round to five inches, the size of the drill. At the lower part of this casing are four cast-iron spreaders, G, seven inches long, fastened to the wood by a hinge; and when the bolt is put into the hole, they are tied down with a piece of twine, as represented in figure 3, with part of the head of the bolt below them. When they are placed exactly right, the bolt is drawn up, which breaks the twine, and forcing out the spreaders, fills the drilled hole, as it appears in figure 4. A piece of timber, as represented in fig. 4 by the dotted lines, is then screwed down, and holds all fast.

I am, Sir, respectfully,
Your most obedient servant,
JAS. MOON.

Dover, Oct. 29th, 1824.

MECHANICAL DIFFICULTY SOLVED.

The inquiry made by W. S. K. in Number 74, p. 285, relating to a piece of wood or cork remaining stationary when placed in the centre of a revolving bason of water, may be answered, that it arises from the inertia of the water, or that property of matter by which it resists motion when at rest, and resists rest when in motion. This inquiry may be thus explained:—The particles of all fluids are supposed to be globular, so that when the bason is put into a revolving motion, all those particles which are in immediate contact with it will be whirled round, each upon its *axis*, and these again will communicate a simultaneous motion to those particles which are in immediate contact with them, and so on until motion is communicated to the whole mass; and if, after this has taken place, the motion of the bason is stopped, the water will still continue to move for a considerable time, but in a reversed order; that is, the particles next the side of the vessel will, from their attrition upon it, first cease to move, and then again, by their action upon others, nearer and nearer the centre, until motion is completely destroyed.

I am, Sir,
Your obedient servant,
J. Y.

63½, Red Lion-street, Clerkenwell.

"THE COMPENDIUM STOVE."

(From the Philadelphia Gazette.)

BURNING OF WATER!—Our town (or at least a part of it) has been kept in a state of excitement for three days and half, by a discovery which has been made of a mode of using *water for fuel!* The proprietors of coal-mines and woodlands are all in alarm—(by Monday we may expect that the panic will spread among the wood sawyers and coal-heavers)—the question whether it will be advisable to let the Liberties have the Schuylkill water, now we have this new use for it, already begins to be discussed—and fears have been expressed lest our Professor of Pyrotechny should carry his art so far as to set fire to the Delaware! As he has, however, given his word and honour that before he attempts any thing of this kind he will give suitable notice, so that the ships may be removed, no apprehensions on this score need, for *the present* at least, be entertained. In the existing state of public feeling, those, perhaps, are most rational who talk of petitioning Council to assess an additional tax on such as *burn* the Schuylkill water as well as *drink* it.

Seriously and soberly—Mr. Augustus Day, who resides at No. 124, North Third-street, has invented a stove, by which it has been calculated a room may be kept warm for a whole day, and no more than *four cents worth* of Lehigh coal be consumed in that period. It is of small size, and in shape an inverted cone, with several longitudinal openings near the apex. On a grate within rests a small quantity of coal. A pan of water placed beneath the openings ensures a constant supply of vapour. In passing through the ignited coal, the aqueous vapour is decomposed, and we have that powerful heat which is produced by the combustion of oxygen and hydrogen. The cover of the stove is attached to a moveable section of pipe, which is raised and lowered by a fixture similar in principle to that of a suspended lamp, and by this contrivance the fire is regulated. So powerful is the heat, that a small quantity of water thrown into the stove is immediately decomposed, and the combustion of its component parts follows of course. Of this we have ourselves been witness.

The *principle* of the invention has long been applied in the mechanic arts, especially by the *blacksmith*, who, as is well known, when he wishes to increase the heat of his fire, throws on it a small quantity of water. Of late years, chemists have, in their compound blowpipes, made sundry new and very valuable applications of this principle; but the honour of applying it to domestic economy belongs to Mr. Day alone.

CONSUMING SMOKE.

Sir,—Having seen a variety of contrivances for consuming the smoke of steam-engine and brewers' fires, all of which are, more or less, complained of as obstructing the draft, and consequently reducing the heat applied to the boiler, I beg leave to suggest the following contrivance for the consideration of your readers. I am not sanguine of its success, but shall feel obliged by any remarks and opinions that may be offered on it by any of your Correspondents.

I propose that an opening shall be made in the chimney, and alongside of it a small globular furnace shall be built of fire-brick, to which shall be attached a pair of double blacksmith's bellows, to be worked by the engine, which shall constantly blow a stream of fire into the chimney that will, I conceive, ignite the smoke as it passes up, and cause it to rise in a flame. I propose that the furnace-fire, to which the bellows is applied, shall be constantly supplied with small coal by a hopper and two fluted rollers, similar to those used for crushing malt, and worked by the engine. It will be observed that the bellows are double, consequently one of them always giving the effect.

I am, Sir, &c.

W. R——y.

THE "QUESTION IN OPTICS."

Sir,—The science of Optics having proved that there must be an extent beyond which a sufficient image of an object could not be intelligibly reflected on the retina of the human eye, the question of what that extent might be, must, in my opinion, remain problematical until the power of sight is brought to one mathematical standard. The *time* may be made out, by *inference*, on "*a dial of four feet diameter*," as, at this, the position of the *two hands* can be sufficiently seen, because of the uniformity of the division of the hours, and the *established* places of 12, 3, 6, and 9, and their *known* intermediates; but if, on the same four-feet tablet, some new figures, of the *size proposed* on the clock, were to be inscribed, the test of the question of "S." (in Number 72) would be more in point with the information sought. I can only advance a geometrical step towards the required solution, by informing "S." that an object five feet in height and three miles distant, would produce two principal rays, the one from the top and the other from the bottom of such object, which, in passing through a flat glass placed vertically at one foot distance from the eye, would, if truly marked on such glass, be reduced to *one thirty-second part of one-eighth of an inch*, or rather one 5280th part of five feet. This calculation may, perhaps, induce others to give the question a thought; but I *finally think* that it is a *mixed query*, like that of the everlasting "*turn screw*," and requires knowledge beyond the mathematical rules of mechanism to solve.

I am, Sir, &c.

A MUCH AMUSED AND CONSTANT READER.

LIGHT AND DARKNESS.

Sir,—The facility which your liberal and instructive Magazine offers for the publication of all sorts of opinions, induces me to say a word or two expressive of my abhorrence of the perversion of truth, when victory alone in argument is the object to be gained. In a certain profession some grounds exist for sophistication, and the thing is understood to be so, notwithstanding the effect is to set truth aside; but it is mortifying, to say the least of it, when indisputable facts, the knowledge of which is derived from no less than divine authority, are treated with levity and undervalued, and for no other purpose than to make a display of learning and abilities, in order to impose on those of inferior talent a tissue of nonsense, under pretence of publishing to the world a great discovery. I happened, in looking through the last volume of your work, to peruse the paper Number 40, page 188, on *light and vision*, wherein much pains are taken to prove there are no such things as light and darkness: and, indeed, I was disappointed at not meeting some specious proof advanced, that we have no eyes, as the writer insists, " it is the mind sees, and not the eyes." The eyes of course are useless, and of course made in vain! I will not dispute this point with the learned writer, as who knows but he may be a Member of Parliament, or of the law, wherein policy is always right, or the profit of the calling sufficient to make black white. But as a man and a Christian, I cannot suffer myself or others to be talked, and quirked, and bamboozled out of the right of thinking for ourselves, particularly when fortified in our opinions by the language of divine inspiration. The word of God says, " Let there be light." Now, Sir, is it wise in any man to say that " light is useless, and therefore has no existence?" Might it not as well be flourished out, that the world was not created, for its beginning has no other authority than what we have for the creation of light? so that if there be no light, great is our darkness indeed! And if there be no light, I would ask, why should there be any difference in darkness, by which without light we see, and with darkness, at times, we cannot see? Your Correspondent likewise says, there is no darkness, or what he calls shadow. Still holding to my Bible, which the *palaver* of no man shall make me undervalue, I read there, that darkness has as much being as light; as it is written, " the darkness was great," and " thick darkness, such as might be felt." When you, Sir, or any one else, can furnish me with better proof than the word of God, I will change my way of thinking, but not until then.

I am, Sir, yours, &c.

Jacob Morine.

PLAN FOR PURIFYING COAL MINES FROM CHOKE-DAMP.

Sir,—In a letter which I took the liberty of addressing to you a short time back, I therein stated I could suggest a Plan which would effectually Purify the Air in the most extensive Coal Mine, by expelling the carburetted hydrogen Choke-damp. I shall, as briefly and explicitly as my small share of learning will enable me, explain my plan for accomplishing this most desirable object. The specific gravity of the first and the most dangerous is described as considerably lighter than atmospheric air; consequently it will always occupy the upper or highest parts of the mine; and as it is admitted that it is generated from the face of the mine (or strata of coal) on which the miners are constantly at work, these stratas of coal seldom being exactly horizontal, but generally on an inclined plane, the engine and shaft being usually at the lower end, from whence the mine is, if I may use the term, worked up hill. In this case, whether the gas is generated from the face of the mine or otherwise, still its being so far from the bottom of the shaft causes it to accumulate in this particular part of the mine, even if the roof is perfectly horizontal, but more so if there is the least elevation. Compressed against the roof of the mine

by the pressure of atmospheric air from the bottom of the shaft, the gas, like a light liquid upon one specifically heavier, will find its level. The carbonic acid gas, on the contrary, will always, if there is any descent, flow like water towards the lowest place of the mine. For these reasons I would recommend that a recess or cavity, in the form of an inverted funnel, be made in the roof or top of the mine, in the centre or highest part of the face, and that the same shall be as large as the state of the roof will admit: into this, if the same is made in the highest part of the mine, the gas will spontaneously flow. From the centre or top of this funnel, I propose that a hole, six or more inches in diameter, should be bored upwards to the surface. This may appear (because new) difficult to effect, but I have no hesitation in saying it may be effected at less than half the expense of boring downwards: in the latter, when boring to a great depth, a great part of the expense is caused by the loss of time necessarily taken up in drawing up the rods to empty the auger, and to change that for the chisel. In boring upwards the chisel only will be required, and the rods will only require to be withdrawn occasionally to repair the chisel, as the soil, &c. cut out by the chisel, will keep falling down between the rods and the outside of the hole to the bottom of the pit. The rods may easily be worked by levers and pulleys. When a hole is completed to the surface, the gas may be easily forced to this part of the mine in the following manner:—Let a tin, copper, or sheet-iron pipe (air-tight) be fixed to the nozzle of a pair of large bellows at the top of the shaft, or (if not too remote) at the engine-shaft, which may be made to work the bellows when necessary; let the pipe be continued down the shaft and along the top or roof of the mine (fixed up with wooden wedges) towards the lowest part of the face of the mine; have as many branch-pipes as may be necessary, and at the end of each a stop-cock. A long leather flexible pipe or hose, such as the firemen use, with a brass or other tube attached, may be screwed alternately to the different ends of the pipes, beginning at the lowest or farthest end (from the funnel) of the face of the mine; and through this medium the air may be placed against the face of the mine as often as may be deemed necessary. Thus may the air be purified in the most remote parts of the mine, and, besides expelling this dreadful enemy of the miners, the plan will furnish, in lieu of the air contaminated by their breath, pure and refreshing atmospheric air.

If the plan of boring appears impracticable or too expensive, I would suggest another plan, nearly as efficacious. Instead of bellows, substitute an air-pump: instead of one funnel or cavity in the roof, make several along the face of the mine, into each of which conduct a pipe, with the end made similar to the broad end of a trumpet, and let the same be turned upwards to near the top of the different funnels or cavities. This will, by working the pump, draw out all the dangerous gas and contaminated air, which will be replaced by pure atmospheric air from the shaft.

If there is any remote part of the mine which requires to be explored, and where there is reason to think this dangerous gas is accumulated in a state of explosion, by adopting the following plan the same may be exploded without danger to the parties:—Provide a strong box, similar in shape to a sedan-chair, sufficiently capacious to contain two persons: in the centre of the hind part of the same let there be placed about six inches square of very fine wove wire, to admit air, with a slide to shut occasionally. In the front have a plate of thin crown glass, sufficiently large for the persons inside the box to see their way through; and let this also be protected with a slide outside. One of Sir Humphry Davy's patent lamps, placed on the outside of the front over the glass, will indicate to the persons inside when they approach a part of the mine where the atmosphere is explosive; on the dis-

covery of which they have only to retreat backwards to a sufficient distance, and then explode the gas by means of a common serpent fired from a pistol through an aperture in the front of the box. They may be provided with means to relight their lamp, and I presume to think they would be sufficiently shielded from the effects of the fire. I have always observed that the fatal accidents generally occur on a Monday morning. Would it not be a means of diverting the danger of an explosion, by sending down two of the men to try the above experiment before the whole descended? The box might be kept constantly ready at the bottom of the shaft.

I am, Sir,
Your obedient servant,
A STAFFORDSHIRE FARMER AND LAND-DRAINER.

IMPOVED AUGER.

The following account of a New Auger, invented by Dr. Church, of Birmingham, is given by the Editor of the London Journal of Arts and Sciences:—

"This improved auger (indeed we have seen several of them of different sizes, but the most perfect one we now refer to) is one inch and one-eighth in diameter. We first tried its effects upon a piece of dry deal, four inches thick, held in the left hand, without any other support, and turning the auger by the right hand in the way that gimblets are usually turned, passed the auger through the four-inch deal in fifty seconds. With the assistance of a bow, it was made to penetrate through a post of seven inches square in twenty-one seconds, and in the hand of an expert workman, there is no doubt but that its progress would be much more rapid. It cuts a perfectly smooth hole, and clears itself as it advances.

"The utility of an auger possessing such superior advantages to shipwrights, as well as a variety of other artisans, must be immediately obvious; and one circumstance which renders it still more valuable is, that its form is such, that it can be sharpened, from time to time, upon an ordinary grindstone, without in the slightest degree altering its figure; indeed, it will retain the same form and properties even though ground down to within a short distance of the stem.

"Not having the inventor's permission, we refrain from publishing a particular description of this instrument; but as soon as the specification is enrolled, which will be in May, we propose to ourselves the pleasure of presenting it to our readers in a more perfect state."

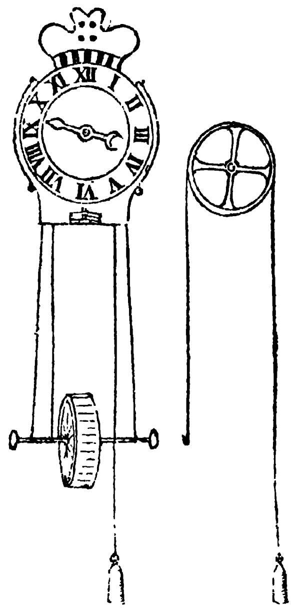
EXTINGUISHING FIRE.

M. Cadet Vaux, reflecting on the circumstances of a fire when it occurs in a chimney, was led to endeavour at its extinction, by rendering the air which passes up the flue unable to support combustion. This object he obtained by the simple means of throwing flour of sulphur on the fire in the grate, and so effectual was it, that a faggot suspended in the chimney very near the top, and consequently near the external air, when set on fire and burning with great fury, was instantly extinguished on the application of the sulphur below. This process is the more applicable, inasmuch as it does not require that all the oxygen in the air should be converted into sulphurous acid gas before it passes up the chimney; on the contrary, a comparatively small proportion of the latter gas, mixed with common air, is sufficient to prevent its supporting the combustion of common combustible bodies.

SUBSTITUTE FOR GLASS IN LANTERNS.

M. Lariviere, a mechanic at Geneva, has conceived the idea of substituting for glass in lanterns, plates of polished iron, pierced with small holes, regularly placed, and very close to one another. These plates allow the light to pass through them extremely well, and are much superior to metallic wires, which are easily deranged. The same person is at work upon a machine by which he will be enabled to pierce, with regularity and expedition, a number of small holes, so as to perform in a minute the same labour which, according to the existing methods, it would require an hour to execute. This invention will be very serviceable in the construction of sieves and filtering vessels.

ONE-WHEEL CLOCK



SIR,—Having seen in your work some account of a very simple clock, with *two wheels only*, I beg leave to send you the rough draft of one in my possession, having one wheel only. It bears the name of Arnold Finchett, Cheapside, who, I understand, was a very ingenious tinman, about ninety years ago.

I am, Sir, yours, &c.

B. P. C.

10, Walcot-place, Lambeth.

Description.

The case is made of tin, the face of glass, with a thin paper dial behind, the glass being perforated in the centre, through which moves the pivot of the only wheel, having an opposite pivot corresponding and running through the back of the tin case. On this spindle is fixed the tin wheel, having a groove, over which runs a fine catgut line, having a hook at one end, to which is attached a tin bottle, containing small shot. The motion to this wheel, by the moving of the line, is given by a barrel made of tin; also with a spindle passing through it, having a brass knob at the end, to which a line, also of fine catgut, is attached, and balances the barrel, being fastened at the other end of the line to the bottom of the clock-case. By turning the two knobs equally between the thumb and finger of each hand, you wind the catgut round the spindle of the barrel, which will ascend as high as the bottom of the clock-case; not omitting to mention, that the hollow tin barrel contains a liquor * about one quarter the contents, so that it would run down and unwind the catgut over the spindle, were it not checked by the hook, from the end of the catgut line passing over the grand wheel. The shot in the opposite end are regulated either by adding or diminishing, so as to check the descent of the barrel, and regulate the movement of the hand, which is fixed on the spindle of the wheel. This clock goes well for 24 hours, and I had it going for many weeks without losing or gaining time. There are two tin doors,

* When a boy, about forty years ago, I had the curiosity to make a fine pinhole in the barrel, to find out if it contained quicksilver; but I was disappointed, for I found nothing but a tasteless and colourless liquor, like water. I closed it up, and it does not appear to have lost any of its substance in quantity or weight ever since.

which open on a hinge below the dial-plate, so as to get at the inside to clean the dust; and moreover, at night, there is a small tin lamp fixed inside, in the bottom of the case, which shows the hour through the transparent face, the smoke going out at the top of the clock-case, which is formed like the top of a dark lantern, and is wholly free from the noise usually attending clocks and watches in the chamber of a sick person. When the clock wants cleaning, it is only necessary to blow in it with a pair of bellows, and touch two pivots of the wheel with a feather and oil.

THE AMSTERDAM CANAL.

This is a new grand Canal, which connects the harbour of Amsterdam with the Texel, and which, for magnificence of design and for the manner of its execution, reflects high credit upon the Dutch nation.

The communication between the Texel and the port of Amsterdam has hitherto been through the Zuyder Zee, which, always a difficult and dangerous navigation, owing to numerous sand-banks, has latterly proved almost a fatal inconvenience to the commerce of this city This noble canal is an effort towards restoring Amsterdam to all its former greatness, by enabling it to compete in natural advantages with the other commercial cities of Europe; and, although only commenced about three years ago, is already in such a state of completion that ships of war, as well as merchants' ships, can now, it is said, sail directly out of the Texel, over this inland navigation, into the very town of Amsterdam. The lock into the harbour is, of course, upon an immense scale, and exhibits a beautiful specimen of workmanship, both in the masonry and the carpentry. This, and the lock into the Texel, are the only two locks upon the whole line. The canal requiring to be continued into the deep water of the harbour, was obliged to be carried out for some distance on artificial ground, supported between two large dikes or banks. But this was a difficulty to which the Dutch are accustomed, and one which they well know how to overcome. Already this part of the work, though yet unfinished, seems to defy the utmost power of the winds and waves. The workmen being now occupied in raising these banks still higher above the water's reach, afforded the writer an opportunity of observing the mode of the proceeding, which is simply this:—The side next to the water presents a smooth and regular basket-work of strong osiers, strengthened at intervals by powerful withy stakes; within this frame-work are laid, in a horizontal direction, large bundles of green osiers, as closely as they can be packed together; and a slight quantity of mould being thrown in, just sufficient to fill up the interstices, another range of similar bundles is placed transversely with the last, and over this is laid a thin layer of mould well trodden down; and thus the work proceeds, narrowing to the top, where the whole is well secured by a strong covering of clay. Thus the bank soon becomes a mass impenetrable by air or water.

INQUIRIES.

NO. 95.—STAINING GLASS.

The most expeditious and cheap method of Staining Window Glass, so as to resemble colours burnt in? It is most desired to be done when the glass is in the frame, or light, as it is called. C. R.

NO. 96.—CRYSTALLIZATION OF ALUM.

SIR,—I dissolve one pound of Alum in three pints of water by heat; when cold, a considerable portion of this will crystallize. Possibly, among your well-informed readers, some one would be good enough to say if there is any possible means to prevent the crystallization, and retain the full strength in solution, when cold, or very materially so, without discolouring the same.

A CONSTANT READER.

Notices to Correspondents in our next.

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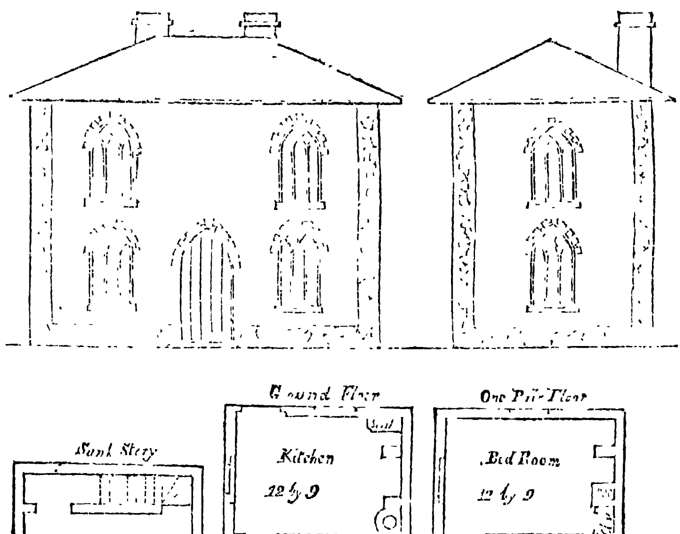
Mechanics' Magazine,

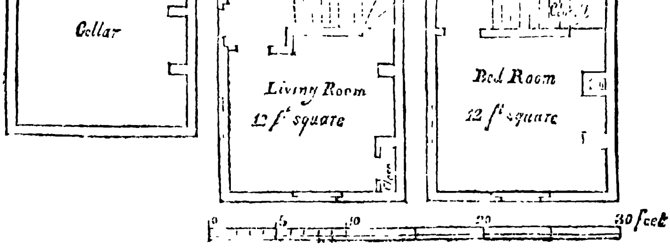
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 77.] SATURDAY, FEBRUARY 12, 1825. [Price 3d.

"Many of the blessings universally desired are very frequently wanted, because most men, when they should labour, content themselves to complain, and rather linger in a state in which they cannot be at rest, than improve their condition by vigour and resolution."—*Dr. Johnson.*

DESIGN FOR A COTTAGE.





DESIGN FOR A COTTAGE.

The prefixed are drawings of the Elevation and Ground Plan of a Cottage, which obtained the premium offered by X. X. p. 383, vol. II. with the alterations introduced by that gentleman in the building, which he has since actually erected, and which having personally seen and examined, we can assure our readers is both very neat and very commodious.

NAVIGATING STEAM-ENGINE.

SIR,—As your valuable Magazine is the medium for the communication of improvements and discoveries, I send you information of a novel Steam-Engine of mine. It consists of two cylinders, each two inches in diameter internally, and ten inches externally; the cylinders are heated to the degree of being red hot; there are twelve drachms of water forced into the cylinders by means of condensed air; the water is immediately converted into steam, which gives the force of 1500 atmospheres, and works at the rate of 40 strokes a minute: 18 inches is the extent of a stroke. The whole apparatus weighs two tons and a half The idea that the pressure of steam is in proportion with the temperature is erroneous. For instance, one cubic inch of water put into a boiler of 10,000 cubic inches, and heated to 210 degrees, gives the pressure of 20lbs. on a square inch; but when heated to the degree of being red hot, the pressure is 200lbs. on a square inch; if double the quantity of water is put in, the pressure will be 600lbs. Four cubic inches of water give the pressure of 1000lbs. when the whole vessel is heated red hot.

D. THOMAS.

18, Union-street, Borough.

IRISH LIME-KILN.

SIR,—Your Correspondent G. C., in No. 75, has favoured your subscribers with a sketch of a Kiln for burning Lime with Turf, &c. as used in Ireland. I am so well persuaded of the utility of this kiln in various ways, that I cannot refrain from requesting some more detailed instruction, relative to its construction and different parts.

First, I would ask, What is the horizontal line marked on his sketch, and to which the word *swarp* is attached, as I read it?

2ndly, To what height the kiln is filled at first?

3rdly, Are the turf and limestone *mixed* from the *bottom*, or is there a layer of turf first put in?

4thly, Where is the kiln ignited, at top or at bottom? for this does not appear in the sketch.

5thly, Is one side of it open, and is there also the opening at bottom; or is either of them covered, and with what?

6thly, Is there a grating at the bottom of the kiln at the narrow part, or is that part open?

By inserting the above questions, at your earliest convenience, you will particularly oblige one of

YOUR FIRST SUBSCRIBERS.

February 1st, 1825.

SCREW-DRIVERS.

SIR,—The following is the result of several experiments made with a long and a short Screw-driver. The former was two feet in length, the latter eight inches, from the handle to the point. The handles were turned to receive a line coiled round the same, and which passing over a pulley, had weights attached to it, till the power required to turn the screw was obtained. The diameter of each handle was two inches and a quarter; the width of the points nearly half an inch, or one-fifth of the handles; the screw used was two inches long (No. 17); the hole was bored in the usual manner in a piece of yellow deal, and a little grease was put on the point of the screw. A piece of steel wire was driven into the handle, and passing through a thin piece of iron, kept the handle in its proper position. On the point of

the wire a lever rested, to which weights were added to the required pressure. The point of the screw-driver was prevented slipping by a small wheel, fixed near the point, working between four upright pieces of wood; the screw-drivers were made very strong, and possessed, therefore, very little elasticity. The following were the results obtained:

	Weight required to turn the screw.	Pressure on screw.
At the commencement	3lbs.	9lbs.
Regular increase to the termination of the part tapped	17	16
On the part not tapped entering the wood	22	23
Regular increase, till the screw was driven home	37	30

A CARPENTER.

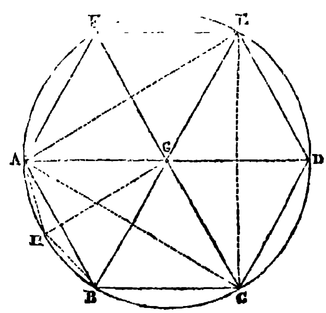
MECHANICAL GEOMETRY.—No. VIII.

(Continued from Page 297.)

PROBLEM XIV.

Within a given circle to inscribe a regular hexagon or polygon of six sides.

Let ABCDEF be the circle within which it is required to describe a hexagon.



Take the radius AG of the circle in your compasses, and apply it from A to B, and from B to C, and so on quite round the circle, which it will do exactly six times; then join the points AB, CD, &c. and the thing is done. For if we draw lines from the points A, B, C, &c. to the centre, we shall have six triangles equal and similar, or *identical triangles*, and all the angles round the centre, G, are together equal to 360 degrees (by Theorem 1, part 1.); and as the three angles in each triangle are equal to each other, each of them will be equal to 60 degrees; that is, for instance, the angle AGF is equal to 60 degrees. But there are six of these angles round G; therefore 60 multipled by 6 is equal 360, the number of degrees in the whole circumference, ABCD, &c.

Note.—This problem, though known to most practical mechanics, I have thought proper to introduce; because, though they are acquainted with the fact, it is also necessary that the reason *why* it is scientifically true should be fully known to every one who wishes to gain a knowledge of Geometry as a science.

We may here also observe, as in the last problem, that it furnishes a means of drawing any polygon when the number of sides is divisible (in this case) by six; for if we bisect AB, for instance, by the line GH, we shall have the line AH or HB for the side of a polygon of twelve sides; and by bisecting AH again, we shall have a polygon of twenty-four sides, and so on.

It is also evident that, by means of this problem, we can inscribe an equilateral triangle in a given circle; for, joining the angles AC, CE, and EA, we have the triangle required.

General Observation.

I shall now conclude the *second* part of Mechanical Geometry; as, from what has hitherto been shown, we are in possession of no strictly geometrical method of describing the other polygons; as the pentagon of five sides, the heptagon of seven, or the nonagon of nine, &c.

I shall not give those approximate solutions found in most authors, till I have exhausted all the legitimate methods we are in possession of, but shall reserve a part by itself for the *mechanical* solution of problems; which, though of great use to the workman, must not be considered as geometrical methods, with regard to their accuracy. I shall, therefore, only add, that, with regard to describing polygons round a given circle, it is first necessary to inscribe one of the required number of sides, and then from each of their angles to draw the tangents to the given circle, which will be the required polygon circumscribing the circle.

In the ensuing part, I shall endeavour to familiarise the doctrine of proportion, and its application to the division of lines and surfaces, and embrace every problem and theorem that is likely to be of practical utility to the workman, or assist the measurer in his calculations, and, as hitherto, strive to adapt to actual practice the truths that may be elicited.

I am, Sir, &c.

G. A. S.

(*To be continued.*)

STRENGTH OF ROPES.

The following translation, with which we have been kindly favoured by a Correspondent (Mr. R. W. Dickenson), of a paper which appeared in "The Philosophical History and Memoirs of the Royal Academy of Sciences of Paris, from 1699 to 1720," furnishes some farther very valuable information on the question proposed in No. 69, p. 207, and answered by Mr. Amey, No. 75, p. 303.

Experiments to know whether the Strength of Cords exceeds the Sum of the Forces of the Threads which compose them: delivered as a Lecture before the Royal Academy of Sciences at Paris, Feb. 21st, 1711, *by* M. DE REAUMUR.

We are prejudiced in believing, that a cord, composed of different threads twisted together, has a force which surpasses the sum of the forces of all the threads which compose it; I mean, for example, if we make a cord with six threads, each of which will bear a weight of five pounds without breaking, that the cord made with these six threads will bear a weight above 30 pounds. Several learned men agree with the vulgar in this opinion, as I had an opportunity of seeing by the objections which were made, by some of the most illustrious members of the Academy, to a passage in the Memoir in which I examined the silk of spiders. This passage treated of the strength of the filaments of silk. A skilful geometrician pretended even to have found a demonstration of the proportion in which the twisting increases the strength of the cord above the sum of the forces of all its threads. It seemed to me, on the contrary, that it was from not having examined the matter closely enough, that it had been imagined that the twisting increases the strength of the cords; that every thing being well considered, we shall find, perhaps, that, far from increasing, it diminishes it; and that this is one of those physical problems which cannot be resolved but by physical experiments, I thought it would be of some use to mechanics to endeavour to resolve them. We might often expose the cords that we make use of to be broken, if we should reckon too much upon their strength. All that is done in making cords, or in twisting the threads about one another, is to put them all in a state of contributing something to sustain the force, or the weight that is made to act on the cord, and, at the same time, to dispose each thread in such manner that it is easier to break it than to make it slip, or to disengage it from those which surround

it. It is this which gives us the facility of making very long cords with very short threads, as we see in cords made of hemp, flax, wool, and silk; for we may look upon the filaments of silk and wool, which are commonly made use of, as little cords. Each thread being pressed against those that surround it, and being twisted with these threads, opposes, by its friction, such a resistance to the force which draws it, that it is more difficult for this force to overcome the resistance of the friction than to break the thread.

But does it follow, from this disposition of the threads, that the sum of their forces is smaller or greater than the forces of the cords are? It is not possible to decide this by reasoning alone. We see plainly, that in twisting several threads together, we shorten each thread, and that the cord gains in thickness what each thread loses in length. If we regard the cord only in this view, it is evident that its force is increased; for, every thing else being equal, the thickest cords are the strongest. If, for example, we make a cord by twisting five threads about one another, and the twisting shortens each thread one-fifth, it is evident that the thickness of the cord gains five-fifths, and the length of the threads is diminished; from whence it seems evident, that the strength of this must be equal to the sum of the forces that six threads would sustain separately. There is also another way in which the twisting seems to augment the strength of the cord. The weight, which draws the cord, draws each thread obliquely, so that one part of this weight is employed to press these threads one against the other. Being each less drawn according to its length, the cord which they compose might be capable of resisting a greater effort than that which all the threads that compose it can sustain, when they are drawn perpendicularly. These are the views favourable to the twisting; but, on the other hand, we shall see that it weakens the strength of the cords. If we wish, in order to a cord's having a force equal to the sum of the forces of the threads which compose it, that the weight fastened to one of its extremities should act against each thread only in proportion to the strength of this thread, then we shall find that the twisting weakens the cord; for if the weakest threads are charged as much as the strongest, or if some threads of equal strength are much more charged than others, they will break, and the weight will fall upon the threads which before were the least charged. Now the weight that draws a cord, draws each thread that composes it, more or less, in proportion as this thread is more or less stretched, and more or less thick; and in twisting these threads, it is impossible to dispose them in such a manner that the weakest shall be less stretched than the others: sometimes the thickest are the weakest; each thread, therefore, does not contribute in proportion to its strength to support the weight. If, for example, in a cord composed of six threads, there are four which contribute only half their strength to sustain the weight, the cord must be considered as if it was only composed of four threads.

Besides, since in twisting the threads they are stretched, it is plain that the twisting is equivalent to a weight which would draw each thread, and to a weight greater or less, according as the tension that it produces is greater or less; that is, the more the thread is stretched, the less it is in a state to sustain a weight equal to that which it would sustain naturally; the twisting alone is sufficient sometimes to break the threads, as we find by experiment, when they are too hard twisted. The same twisting which increases the strength of the cords in some places diminishes it in others. But does the increase surpass the diminution? On this geometry throws no light, any further than we make arbitrary suppositions, which consequently determine nothing. We cannot know whether, among these suppositions, we have chosen those which are conformable to the effects of nature; we must, therefore, here, as in all other philosophical doubts, have recourse to experiments. Those under consideration are simple, and easy to execute. I shall relate precisely some of those that I have made; they will teach us what we are to think of the increase in the strength of cords above that of the sum of their threads.

Experiment I.—I took a bottom of white thread, such as is commonly used, and having cut a large piece off it, I fixed at one end different weights, from 1lb. to 10lbs. This bit of thread sustained 9½ lbs. without breaking, and it broke when I had fixed to it a weight of 10lbs.; it was therefore evident, that each of the two parts which remained after the division of this thread could at least bear a weight of 9½ lbs., since they had already sustained it without breaking. I afterwards doubled the longest of these ends of thread, and twisting the two pieces together, I formed a little cord, composed of two threads, each of which was able to bear 9½ lbs.; consequently, if the twisting had increased the strength of the cord above the sum of the strength of the threads which compose it, this cord ought to have borne above 19lbs. It was well twisted, without being too much so; nevertheless it broke when I had suspended a weight of 16lbs. to it, and it only sustained 15½lbs. without breaking. So far, therefore, from the strength being increased by the twisting, it was diminished about one-sixth.

EXPERIMENT 2.—I afterwards fixed a weight of 6½lbs. to another thread, taken from the same bottom; it sustained it without breaking, and broke with 7lbs. I also fixed several weights to two other threads; the first of which supported a weight of 8lbs., and broke at 8½lbs.; and the second sustained 8½lbs., and broke at 9lbs. I took the longest end of each of these three threads, and twisted them into a small cord of three threads; the sum of the forces of these three threads was hypothetically capable of sustaining a weight of at least 23lbs.; the cord nevertheless broke when it was charged with 17½lbs.; the twisting has therefore considerably weakened it.

EXPERIMENT 3.--Having likewise taken four bits of thread, and knowing by the experiments that the first could sustain 8½lbs., and that it broke with 9lbs.; that the second could sustain 6½lbs., and broke with 7lbs.; and that the other two had borne 7lbs., and broke with 7½lbs., I made a cord by twisting these four threads. I knew by the experiments just mentioned, that the sum of the forces of these threads could at least sustain a weight of 29lbs.; I therefore knew that the strength of this cord was less than the strength of the sum of the threads, when I saw it break, after having hung to it a weight of 21½lbs.

EXPERIMENT 4.—To confirm the preceding experiments, I made a new cord, as above, composed of five threads, four of which had borne 7lbs., and broke with 7½lbs.; and the fifth had borne 6lbs., and broke with 6½lbs.; the sum of the strength of these threads was, therefore, at least 34lbs.; the cord, however, broke, after having for some time sustained a weight of 22lbs. As I knew by the preceding experiments, and by several others which I do not think it necessary to relate, that the thread which I made use of had, in the weakest parts, sufficient strength to sustain a weight of 6lbs., and that it was often strong enough to sustain 9lbs., I thought it right to make my calculations without examining any more the strength of the thread which I used; and that if I should find the strength of the cord less than that of the sum of the threads, by considering them as not being able each of them to sustain above 6lbs., I should not be mistaken, since I had never found the strength of these threads less, and I had commonly found them greater. I therefore again made different cords with the same thread, because we cannot too often repeat experiments before we conclude any thing from them.

(To be continued.)

GUNTER'S LINES.

SIR,—I have been accidentally deprived of the perusal of the *Mechanics' Magazine* for some months past, and therefore could not be aware of the request for additional information on the subject of Gunter's Lines, to which I should otherwise very readily have acceded. I am happy to find, however, that my silence has been so ably compensated in the communication by G. A. S., who seems to be an intelligent writer, and perfectly *up* to his subjects. I hope he will extend his paper, and embrace the use of the sliding-rule, which is, perhaps, the most useful mode of exhibiting the logarithmic line of numbers. The uses of the angular lines upon the sector and two-feet Gunter have not yet been touched upon, and would possibly be acceptable to your Correspondents who sign with three brace of initials. Should this be the case, I shall be happy to contribute my contingent of information. These gentlemen seem to mistake the application of the proverbs which concluded my reply to "Unit." They were not directed against a class "who look to your Magazine for information they must otherwise go without." I took "Unit" to be, like myself, an amateur; and I think it no hardship if such men be required to perplex themselves with a little head-work. To the other class, indeed, we cannot be too liberal of information, nor convey it too plainly and familiarly.

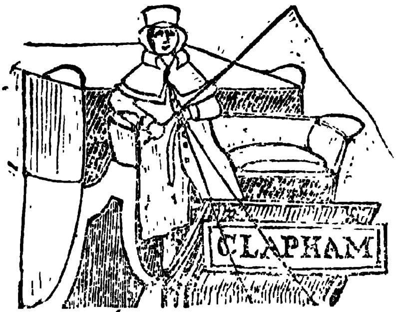
I am, Sir, yours, &c.

MONAD.

ELECTRICO-MAGNETICAL EXPERIMENT.

Mr William Sturgeon, of Woolwich, has shown that a magnetic bar, mounted freely on its axis passing through its two poles, and in this state subjected to currents of electricity, passing from its equator or middle point towards each pole, is thereby caused to revolve on its axis.

IMPROVEMENT IN STAGE-COACHES.



SIR,—The above is a trifling addition to a Stage-Coach, which would, nevertheless, be a great convenience to the public. The improvement consists in hooking or otherwise fastening a moveable board, with the destination of the coach painted on it to the front edge of the present foot-board. The advantage of marking the *front* of a coach, in addition to the sides and back, is this—a person, in a house or on the road, who is looking ou. for a coach, can see the one he wants *before it passes him;* and the advantage to the passengers is, that the coach is not unnecessarily stopped.

The intention of making the board moveable is to enable the coachman to turn it at the end of its journey: thus, for instance, if on one side of the board were painted "CLAPHAM," on the other side would be "BLACKFRIARS," or "CITY," or "CHARING-CROSS."

Some of the Hampstead coaches go to Tottenham-court-road, some to Holborn, some to the Bank: I came to town in one of them the other day, and the coach was stopped four times merely to inquire its destination. The coachman told me that he could not paint, "To the Bank," on the coach, because, at another time of the day, he went to Tottenham-court-road. Now, with a *moveable* board, this is easily accomplished, and a passenger would never find it necessary to strain his eyes to catch the name of the coach *as it passes*, nor to strain his lungs to stop it *after it has passed him.*

I am, Sir,
Yours respectfully,
E. C.

GAS-LIGHTS FOR SHIPS.

SIR,—The frequent accidents which happen at sea and on our coasts, in dark and foggy weather, induce me to hazard the question, Whether it be not practicable, and without any degree of coercion, as it would be attended with very great advantages to all concerned, unaccompanied with expense or trouble, to establish a system of lighting-up ships, after the manner of street night-lamps, in all cases whenever it may be dangerously dark, and their situation is liable to accident or to be productive of injury? Two lanterns to each ship, under such circumstances, might be the means of saving many a ship and cargo, and many valuable lives, particularly when troops are on board. It may probably be the case that lights for this purpose are frequently hoisted; but, as there may be no established law for the purpose, coasters may be unprepared or dilatory in the performance of this necessary duty, and hence the many serious accidents which happen. Lights and a good look-out would not only prevent vessels being run down, but show where buoys and hawsers lie, which have been so frequently fatal to craft.

The introduction of even gas-lights into the navy is far from being impracticable. In large ships the galley could be so constructed that gas might be made throughout the whole night or day if required, so as to supply the burners as fast as it could be consumed. Refining and a gasometer would be unnecessary, and the flame might be protected by a cylindrical or globular lantern of talc or horn. I foresee neither difficulty, inconvenience, nor trouble, in the proposal, and only wish some good may arise from these loose hints, which others, I hope, will improve upon, and which, if feasible, the underwriters have every means of having carried into practice.

Your constant reader,

C. D. Y.

NEW MODE OF EMBOSSING DESIGNS ON WOOD; BY MR. JOHN STRAKER, OF REDCROSS-SQUARE, CRIPPLEGATE.

Raised figures on wood, such as are employed in picture-frames and other articles of ornamental cabinet work, are produced by means of carving, or by casting the pattern in Paris plaster or other composition, and cementing or otherwise fixing it on the surface of the wood. The former mode is expensive; the latter is inapplicable on many occasions.

The invention of Mr. Straker may be used either by itself or in aid of carving, and depends on the fact, that if a depression be made by a blunt instrument on the surface of wood, such depressed part will again rise to its original level by subsequent immersion in water.

The wood to be ornamented having first been worked out to its proposed shape, is in a state to receive the drawing of the pattern: this being put in, a blunt steel tool, or burnisher, or die, is to be applied successively to all those parts of the pattern intended to be in relief, and at the same time is to be driven very cautiously, without breaking the grain of the wood, till the depth of the depression is equal to the subsequent prominence of the figures. The ground is then to be reduced, by planing or filing, to the level of the depressed part; after which, the piece of wood being placed in water, either hot or cold, the parts previously depressed will rise to their former height, and will thus form an embossed pattern, which may be finished by the usual operations of carving.

HOUSE ROOFS.

Sir,—"A Traveller" recommends (in Number 71) that Roofs of Houses should be made flat, and covered with Roman Cement. It will, perhaps, gratify him and many of your readers to know that an architect, who has distinguished himself by the erection of one of the most perfect Gothic or early English Churches of the present day, has been engaged in a series of experiments for the production of a metallic roofing. His attempts have been successful, and he has obtained a patent for an article which must, when known, supersede all others for the same purpose. It is strong, durable, handsome, and cheap. It may be laid to any pitch, requires fewer and less strength of timbers than any other roofing at present in use, and may be formed, as it is put up, into gutters and shoots. The invention is one of great importance, and will very shortly be brought before the public.

I am, Sir,

Your obedient servant,

Abel Handy.

February 1st, 1825.

PEWTERER'S SOLDERING FURNACE.

The Pewterers have long been in the habit of employing *a blast of hot air*, for the purpose of heating and soldering the various parts of their articles together with soft solder, and with very great convenience indeed; the blast of air being quite clean, and not discolouring the parts with smoke, soot, &c.

The small furnace employed for this purpose is of a round or oval shape, and is formed of an exterior

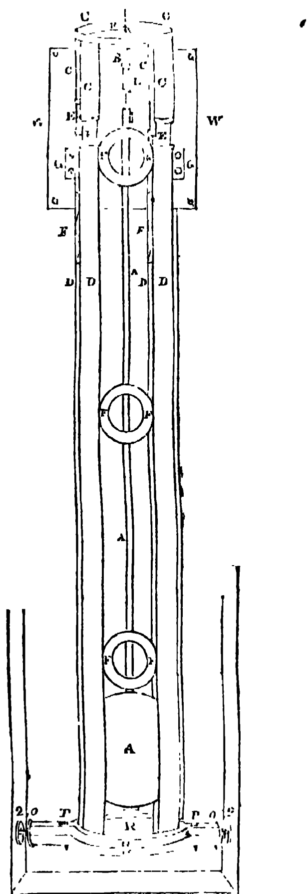
case of sheet or cast iron, lined with fire-bricks or tiles and clay. It is fed with charcoal, and the air from a pair of bellows is made to enter by an iron pipe on one side of it, so as to pass through the burning coals, and to escape through another iron pipe, on the opposite side, above, in the heated state. The parts to be soldered, having a little oil previously applied to them, are to be held in the stream of hot air, until they become hot enough to melt a thin slip of soft solder held to them, which flows between, and unites the parts firmly together.

The fusibility both of the pewter and of the solder is so nearly alike, that a very little excess of heat would melt the pewter articles, and the workmen are, accordingly, sometimes obliged to wet them instantly on the solder flowing, in order to prevent that mischief.

This ingenious contrivance is, no doubt, capable of being used for many other purposes; and, indeed, a very valuable application of *a stream of hot air* has been lately made by Mr. Bryan Donkin, civil engineer, who has taken out a patent for dressing net-lace, &c. by means of it.

SELF-REGULATING PENDULUM.

Sir,—Having been a subscriber to your Magazine (as interesting from its contents, as from its important object of encouraging useful inquiry) since its first publication, I am induced to lay before you the particulars of an invention, I believe, an original one in its conception and application, simple in its principle of operation, and effective in producing the very important and desirable object of attainment to the scientific world, *an accurately Self-regulating Pendulum.* If I am in error upon the subject of its originality, it will give me pleasure to be set right by any of your better-informed Correspondents, who will state the particulars of any published invention similar in principle and application to mine. Prefixed, I send you an outline, indicating the parts with sufficient precision, I believe; but not being a professor of the pencil or graver, you must overlook any slight inaccuracies in the sketch.



Description.

AAA, pendulum, weight, and rod; B, pendulum spring; CC, &c. a ring of brass, one-fifth of an inch in diameter round; to this ring, at equal distances from each other, are welded four brass sockets (also CC, &c.), one quarter of an inch or more in length, of exactly sufficient width, in their bore through their centre, to admit rods of similar size to the pendulum rod to pass up to their points of junction with the brass ring, C. DDDD, four corresponding sockets, fixed (as hereafter shown) at the bottom, and

of sufficient length to approach to within half an inch of the extremities of the upper set of sockets just described, when the four rods seen at EEEE, of the same diameter, and taken from the same coil, as the pendulum rod, have been pushed home to the bottom of the sockets, and the upper sockets and ring have been slipped down upon the upper extremities of those rods, which latter, of course, will then be of equal length, and half an inch more, to both sets of sockets. FFF, &c. rings of brass welded firmly at the sides to the opposite sockets; two at the top, also marked F, are seen in perspective (more than these two cannot be distributed at the two sides, as the swing of the pendulum would be prevented). These rings are to assist in keeping the lower sockets in their proper positions with respect to each other. GG, two brass plates welded to the back of the sockets next to the clock, and screwed firmly to the back of the latter. K, a cross-bar through the centre of the brass ring, C (before described); in the centre of this bar is a slit, through which the top of the pendulum spring passes, half an inch above it, and is then screwed tight by a screw passing horizontally through the centre of the cross-bar. L, the crutch of the escapement in its proper position at the back of the clock, WW, with the pendulum spring inserted. NN, two brass rings, one quarter of an inch square each throughout their circumferences, with shanks at each side of the same square. OO, brass caps, to fasten the extremities of the shanks of both rings together, to which they are screwed. PP, screws, passing perpendicularly through the centre of both the shanks, and fastening the rings and shanks together. QQ, circular brass plates, to the centre of which, by a shank proceeding from the centre of the caps just named, the brass rings and shanks are fixed in a perfectly horizontal position; these plates are screwed to the sides of the clock-case by screws, at equal distances, all round their circumferences. R, a thin brass circular plate, seen in perspective at this point. This plate is of rather greater diameter than the brass rings, NN, between which it is fixed and screwed tight by the means before named. The bottoms of the sockets, DDDD, are firmly welded or screwed, or otherwise fastened to this plate, at equal distances from each other, corresponding in their position with the upper set of sockets fastened to the brass ring, CC.

The mode of adjustment of a similar apparatus to any description of common pendulum, I shall give at the conclusion. I now proceed to explain the operation and uses of the several parts.

The four rods, EEEE, are put into the lower perpendicular sockets, and pressed quite home to their point of junction with the brass supporting plate, R. This must be particularly attended to. The sockets attached to the upper brass ring, CC, are then slipped upon the upper extremities of these rods, quite home also. The pendulum spring is now slipped up through the crutch of the escapement, and the head passed through the slit in the cross bar at the top, and half an inch above it, and then screwed firm by the horizontal screw to its centre. Now it is evident, that as the pendulum rod expands or contracts by the variations of the temperature of the atmosphere, the four perpendicular rods of the same diameter and material, and taken, as before said, from the same coil as the pendulum rod, and of ascertained length (of which hereafter), will be equally affected. These rods meeting a greater resistance to their expansion at their lower extremities from the brass plate, R, inserted between NN, than their upper extremities receive from the brass ring and sockets, CCCC, and the pendulum thereby suspended, and being prevented from expanding laterally by the surrounding and closely-fitting brass sockets, the whole effort of expansion will consequently be accumulated and take effect at the top, and raise the pendulum weights by the head of the spring, exactly so much as the pendulum rod is, in reality, lengthened by the increase of temperature; and the contraction of the rods, in equal proportion with the contraction of the pendulum, will, on the other hand, let the pendulum weight down, as far from the point of suspension as it would otherwise have been brought nearer to it; or, in both cases, keep the weight of the pendulum at exactly the same distance from the point of suspension as it was first adjusted to; forming a self-regulating pendulum of the greatest accuracy.

Mode of Adjusting the Regulating-Rods.

Having obtained a pendulum rod of the proper length, with weight affixed, take from the same coil another, or as many as you please, of two or three inches longer, to allow for such alteration in their length as may be found necessary; suspend them together by the same horizontally fixed wire, and expose them all together to different degrees of temperature. If the expansion is greater in the rods than in the pendulum and rod, reduce the former very gradually in length, until the requisite equal proportion is accurately obtained. Select four (equal in length) for regulating rods: two, or even one, would do; but the uniformity and effect of the action of four, at equal distances from each other, and from the point to be acted upon, will be more correct, as

regulating each other; and in increasing the power to form rods, it must be remembered that the degree of expansion remains unchanged.

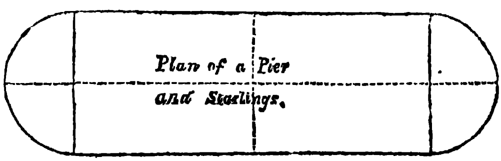
To ascertain whether rods of the same diameter, and from the same coil, possess similar expansive properties to each other, take exactly equal lengths of such wire; weigh them: if they weigh exactly equal, their expansive properties will be found to be the same.

Wishing to preserve, through the record of your publication, my claim to the originality of this invention, and to the peculiar application of the power employed to produce the effect explained, I shall feel gratified by your insertion, in an early Number, of this statement. I have already occupied too much of your time and of my paper to explain more at large the details of my plan, and shall therefore reserve such explanation for any of your readers who may require information upon the subject, which I shall be always ready to afford with great pleasure. Purposing, with your approbation, to continue my communications to you on other subjects on future occasions,

I am, Sir,
Your obedient servant,
ROBERTUS HIBERNICUS

Youghall.

NEW LONDON BRIDGE.



SIR,—I send, for insertion in your useful Journal, a shape of a Starling for the New London Bridge, in the hope that it may meet the eye of those who can avail themselves of its use. It is a rule, in building the piers of stone bridges in running streams, to form the starlings of an angular or acute angular shape, so that the water may pass with the least impediment. The advantage of this I do not dispute; but in viewing Westminster Bridge * at low water, the ravages of time show this to be a bad shape. The starlings are broken and uneven, harbouring sediment and weeds, are very difficult to repair, and in shape *the worst possible* for the stream's admission. This mischief is caused, in my opinion, by the large floating pieces of ice coming in contact with the sharp edge of the starling. What I consider would preserve the structure about being erected (the New London Bridge) from such accidents, would be to have the starlings of a semicircular shape. There is another circumstance in favour of my suggestion—an opinion prevails that the water will have *too much way* through the new bridge when the old bridge is removed; and it is reported that piers are to be built to prevent mischief from the spring-tides. Now, should this be the case, angular starlings will not be wanted, as in the other bridges, to give *ingress* to the stream.

I am, Sir,
Your very humble servant,
JOHN WEBB.

White Cottage,
Back of the Sportsman, City-road.

* The late Dr. Hutton, in his work, "The Principles of Stone Bridges," recommends the mode of building the arches of this bridge as the strongest possible.

A QUESTION IN SCIENCE.

SIR,—If the following question be not too insignificant to propose, through the medium of your very instructive Magazine, I shall feel obliged by your inserting it.

From what cause is it that the at-

332 MINUS—SQUARING NUMBERS.

mosphere's weight is always varying, when the cause of its weight, which is the earth's attraction, cannot but be always the same? Weight is not considered an innate property of matter, but the effect of attraction; so that were the largest planet unattracted, it would remain motionless in space, neither falling in consequence of its mass, nor capable of resistance in the slightest degree; in which case, and space being a vacuum, were it possible to yoke a humming bird by a hair to the planet, it would draw the planet after it without the least possible inconvenience. Terrestrial bodies being heavy, because, attracted by the earth, and their weight, as long as their quantity of matter is the same, being unchangeable, I am at a loss to know why the weight of the atmosphere is not equally permanent; for I cannot think the column of air over us is either increased or shortened every time the barometer rises or falls; nor do I think the column of air longer or shorter over one part of the globe than another, at equal distances from the centre.

2nd. Wherein does chemical combination consist? If matter be inert, it cannot produce either action or effects; and if it be unalterable, it must be the same in itself when chemically combined as when combined any other way. The best description I can give of my ideas of matter being *chemically combined*, is, as sand is in glass, the particles of which, being fused, run into one another, and are unattainable afterwards. Mere contact would be the same chemically as mechanically; so that if chemical change be not the change of essence, it is beyond my power of conception to form any idea wherein it consists.

I am, Sir,
Your obedient servant,
C. D. Y.

MINUS.

SIR,—When I last wrote to you, I was *minus* a rational faith in a received algebraic truth:—a circumstance which constituted a *difficulty* insurmountable by my own means or exertions. By the kindness of yourself and your Correspondents, I trust I am now *minus* that difficulty, and that I possess a *positive* knowledge of which I was very desirous. To you and those of your Correspondents who have so kindly noticed my application, I beg to return my sincere and hearty thanks, and to subscribe myself,

Your and their obliged servant,
PIGER.

SQUARING NUMBERS.

SIR,—Observing in the Second Volume, page 100, of your valuable work, a short method of Squaring any given Number, I have taken the liberty of sending you another, by the insertion of which you will greatly oblige, Sir,

Your obedient servant,
G. MORLEY.

Richmond-street, Walcot-place,
Lambeth.

I have taken the same Example,

47653843

16 . .
609 . .
5676 . .
47625 . .
285909 . .
7624544 . .
38123056 . .
285923049

2270884752668649.

Observe the first figure is squared; then the second line is found by squaring the next figure, and multiplying all the remaining figures to the left of it by its double.

Each figure is removed two places towards the right hand.

Example.—$4 \times 4 = 16$, first line.

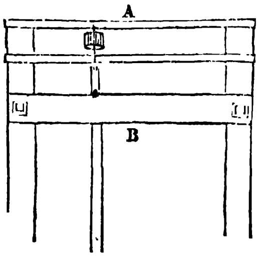
$7 \times 7 = 49$; set down 9, and carry 4.

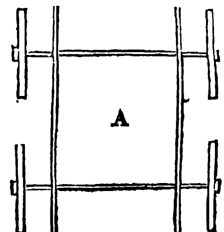
The double of 7 is 14.

$14 \times 4 + 4 = 60$; set down 60, which is equal to 609, second line.

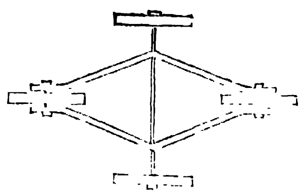
Third line: 6 times $6 = 36$; set down 6 and carry 3; then twice 6 is 12; $47 \times 12 + 3 = 567$; and so on till the end.

NAVAL ARCHITECTURE.





C



SIR,—You have admitted into your pages draughts of the first English ship of war, and of the great Leviathan of the west, the Columbus; and the subject of Naval Architecture is interesting to a nation like ourselves, whose business is so much upon the great waters. The last summer has shown us three competitors for superiority in this branch, one of whom is said to have devoted thirty years to the study. Draughts of the three trial ships, made to the same scale, and showing the general difference of their principal lines, would not, I conceive, be unacceptable, if any of your Correspondents should be able to furnish them to those readers whom either calling or inclination interest more particularly in the matter, and who have not an opportunity of seeing the ships themselves.

It appears to me, that the lever or pendulum, applied by Mr. Vallance to the purpose of giving motion to saws, might be used with advantage, in some cases, for propelling a pair of paddle-wheels in small boats. In this case the boat should have two masts, of height proportioned to the proposed power of the pendulum. Their heads should be connected by two splines, which having the thickness of the masts between them, would give space for the pendulum and its connecting levers to swing in, which might be wrought by one or two men, according to the size of the vessel. Upon the fore-mast might be hoisted a square sail; and upon the mizen, a fore-and-aft sail, if required. The first small figure, AB, will show my meaning. The same machinery might be applied for moving the wheels of a light land-carriage, and where trees are no impediment, the sails might be added; and we might thus, I conceive, have a land-craft, which would be much less fatiguing to work than the velocipede, *alias* dandy-poncy, so much celebrated some years since. In this ship I should propose four wheels, but placed (not in the common way, as at fig. A) diametrically opposite to each other, as in fig. C. The two fore and hind wheels would each have a motion, like the fore-wheel of the

velocipede, in a plane at right angles to their own. This motion would be governed by tillers, either of which might be locked at pleasure, so that we might move the carriage either way, or steer it with one wheel or the other, as we pleased. These are both of them fanciful schemes, but, I think, less fanciful than that of riding through the air upon the wings of a steam-engine.

I am, Sir,
Your obedient servant,
MONAD.

Cromer.

DRY ROT.

SIR,—I have just accidentally seen your Magazine opening the new year 1825, in which I observe "*A Superannuated Quarterman*" is the *only man to be found* who disputes what I have asserted respecting the Waterloo, of 80 guns.

In reply I have only to say, that when your anonymous Correspondent chooses to sign his name and address, he shall have such explanations from me as ought to make him blush either for his own ignorance, or the vain attack he has made against,

Sir, yours truly,
JOHN BURRIDGE.

London, 29th January, 1825.

SHARPENING PENKNIVES.

SIR,—I have perceived in one of your Numbers an inquiry as to the mode of sharpening Penknives, which is very well answered in another place. Whether knives, razors, or any other species of edge-tool, be to be sharpened, it will be found a great addition to the speed of the operation, and to the keenness of the edge, to sprinkle a little *crocus Martis* upon the stone, together with the oil or other fluid.

I am, Sir,
Your obedient servant,
M.

LIST OF NEW PATENTS.

To James Deykin and William Henry Deykin, of Birmingham, button-makers; for their new-invented improvement in the manufacture of certain military, naval, and other uniform and livery buttons. Sealed 23rd December—2 months.

To Daniel Stafford, of Liverpool, Gentleman; for his invention of certain improvements on carriages. Sealed 24th December—6 months.

To Samuel Denison, of Leeds, whitesmith, and John Harris, of Leeds, paper mould-maker; for their invention of certain improvements in machinery, for the purpose of making wove and laid paper. Sealed 1st January—6 months.

To John Heathcoat, of Tiverton, lace-manufacturer; for his invention of certain improvements in machinery, for making lace net, commonly called bobbin net. Sealed 1st January—6 months.

To Pierre Erard, of Great Marlborough-street, London, musical instrument-maker; in consequence of communications made to him by a certain foreigner, residing abroad, for an invention of certain improvements on piano-fortes. Sealed 5th January—6 months.

To Alexander Tilloch, of Islington, Doctor of Laws, for his invention or discovery of an improvement in the steam-engine, or in the apparatus connected therewith, and also applicable to other useful purposes. Sealed 11th January—6 months.

To William Henson and William Jackson, both of Worcester, lace-manufacturers; for their invention of improvements in machinery, for making lace or net, commonly called bobbin-net. Sealed 11th January—6 months.

To Francis Gybbon Spilsbury, of Leek, county of Stafford, silk manufacturer; for his invention of certain improvements in weaving. Sealed 11th January—6 months.

To Goldsworthy Gurney, of Argyle-street, Hanover-square, surgeon; for his

invention of an improved finger-keyed musical instrument, in the use of which a performer is enabled to hold or prolong the notes, and to increase or modify the tone at pleasure. Sealed 11th January—6 months.

To William Hirst, of Leeds, cloth-manufacturer; for his invention of certain improvements in spinning and slubbing machines. Sealed 11th January—six months.

To John Frederick Smith, of Dunston Hall, Chesterfield, in the county of Derby, Esq.; for his invention of certain improvements in the preparation or manufacture of sliver, or slivers, or tops, from wool, or wool and cotton, or other suitable fibrous materials. Sealed 11th January—6 months.

To John Frederick Smith, of Dunston Hall; for his invention of certain improvements in dressing and finishing woollen cloths. Sealed 11th January—6 months.

To Joseph Locket, the elder, of Manchester, engraver to calico and other printers, and copper roller manufacturer; for his invention of certain improvements in producing or manufacturing a neb or slob in the roller, shell, or cylinder, made of copper or other metal, used in the printing of calico, muslin, cotton, or linen cloths. Sealed 14th January—2 months.

To James Falconer Atlee, of Marchwood, county of Southampton, gentleman; for his new-invented process, by which planks and other scantlings of wood of every description will be prevented from shrinking, and will be altered and materially improved in their durability, closeness of grain, and power of resisting moisture, so as to render the same better adapted for ship-building and other building purposes; for the construction of furniture and other purposes, where close or compact wood is desirable, insomuch that the wood so prepared will become a new article of commerce and manufacture, which he intends calling "*condensed wood.*" Sealed 11th January—6 months.

To George Sayner, of Hunslett, county of York, dyer, and John Greenwood, of Gomersall, in the said county, machine-maker; for their invention of certain improvements in the mode or manner of sawing or cutting wood and timber by machinery. Sealed the 11th January—6 months.

To Thomas Magrath, of Dublin; for his new-invented composition, to preserve animal and vegetable substances. Sealed 11th January—6 months.

To Thomas Magrath, of Dublin; for his new-invented and improved apparatus for conducting and containing water and other fluids, and preserving the same from the effects of frost. Sealed 11th January—6 months.

To John Phipps, of Upper Thames-street, in the city of London, stationer, and Christopher Phipps, in the parish of River, in the county of Kent, paper-maker; for their invention of an improvement or improvements in machinery for making paper. Sealed 11th January—6 months.

To William Shelton Burnett, of London-street, London, merchant; for his invention of a new method of lessening the drift of ships at sea, and better protecting them in gales of wind. Sealed 11th January—6 months.

To Jonathan Andrew, Gilbert Tarlton, and Joseph Shepley, all of Crumpsale, near Manchester, cotton-spinners; for their invention of certain improvements in the construction of a machine used for throstle and water spinning of thread or yarn, whether the said thread or yarn be fabricated from cotton, flax, silk, wool, or any other fibrous substance or mixture of substances whatsoever, which said improved machine is so constructed to perform the operations of sizing and twisting in, or otherwise removing the superfluous fibres from the said thread or yarn, and is also applicable to the purpose of preparing a roving for the same. Sealed 11th January—6 months.

To Wm. Booth, of Congleton, county of Chester, gent., and Michael Bailey, of Congleton, aforesaid, machinist; for their invention of certain improvements in spinning, doubling, throwing, and twisting silk, wool, cotton, flax, hemp, and such like materials. Sealed 13th January—6 months.

To Enoch William Rudder, of Edgbaston, near Birmingham, cock-founder; for his invention of certain improvements in cocks for drawing off liquids. Sealed 18th January—6 months.

To William Church, of Birmingham, Esq.; for his invention of certain improvements in casting cylinders, tubes, and other articles of iron, copper, and other materials. Sealed 18th January—6 months.

To Francis Melville, of Argyle-street, Glasgow, pianoforte-maker; for his invention of an improved method of securing that description of small pianofortes, commonly called square pianofortes, from the injuries to which they are liable from the tension of the strings. Sealed 18th January—2 months.

INQUIRIES.

NO. 97.—QUESTIONS IN GUNNERY.

1st. Allowing the bore of a gun to be 5-8ths of an inch in diameter, at what height must the powder in the barrel stand to carry one ounce of shot 30 yards, what height for 45 yards, and what for 60 yards, which is, I believe, the distance a fowling-piece is allowed to carry shot with truth?

2nd. What powder is the best, and whether an advantage would not be gained by mixing two sorts?

3rd. Whether the barrels of fowling-pieces are made strong enough to fire with ball, and, if so, what the diameter of a ball must be to a barrel of 5-8ths in diameter, and what quantity of powder will carry such a ball 50 yards, 70 yards, and 100 yards (which I should imagine it would do), measuring it in the barrel by the diameter of the ball?

4th. What description of barrel is safest, the common sort, or those with contracted breeches? Also what advantage the percussion-lock has over the flint, with regard to safety?

I know not whether it is particular what sized shot are used; but, to prevent mistake in the first question, suppose No. 4: if it is particular, it may be as well to mention the charge for an ounce of three or four different sizes.

NO. 98.—ENTOMOLOGY.

What will be the best method to preserve a collection of dead insects from the depredations of live ones.

INSECTUM.

ANSWER TO INQUIRY.

NO. 82.—WHITENING BRASS WORK.

In answer to Inquiry No. 82, I beg to say that I have frequently boiled Brass-work white, with tin shavings, a few grains of tartaric acid, and an equal quantity of orgal, with soft spring water, in a brass kettle. The brass should be kept covered with water, and suffered to boil about half an hour, till the colour required is obtained, and then immersed in cold water immediately, and washed off. The solution will be good for three or four times, by adding each time a little more of the acid, but is highly poisonous.

CORRESPONDENCE.

"A Young Mechanic's" Plan for upholding the Interests of the Working Classes, would, in our opinion, be subversive of one of the greatest encouragements to industry—the hope of advancement. We admit that they might and ought to turn, to far greater account than they do, the resources which they possess within themselves; but we are convinced it is not by so federative a system, or by such a deviation from the long-existing course of things as he proposes. In a short time he will probably see these resources brought into efficient operation, in a manner which, while it will only make the most of things *as they are*, will accomplish all the good which he contemplates.

Mr. Brougham's Pamphlet on the Education of the People shall be the subject of an article in our next. It should, in the meanwhile, be purchased and read by every one who has the good of the working classes at heart. The profits of the pamphlet are devoted to the London Mechanics' Institution.

G. H. D. will find the information respecting Regnier's Dynacrometer already given, p. 206, vol. I.

Communications received from—X. Queer—S. Ninian—B. P.—An Old Subscriber—Abel Handy—W. R. D.—Joshua V.—R. R.—Hamilton Roger—Minimus—A Country Smith—D. E.—Inquisitor—F. N.—A Constant Reader (of Belfast)—R. W. S.

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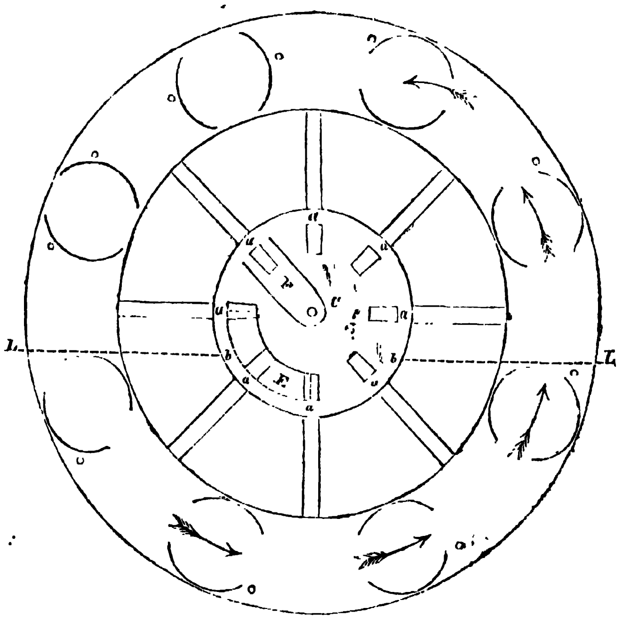
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 78.] SATURDAY, FEBRUARY 19, 1825. [Price 3d.

STEAM-AND-WATER-WHEEL.

Fig. 1.



Sir,—I have taken the liberty of submitting to your notice, and to that of your able Correspondents, a rough sketch and description of a Steam-and-Water-Wheel, which I have had in contemplation many years.

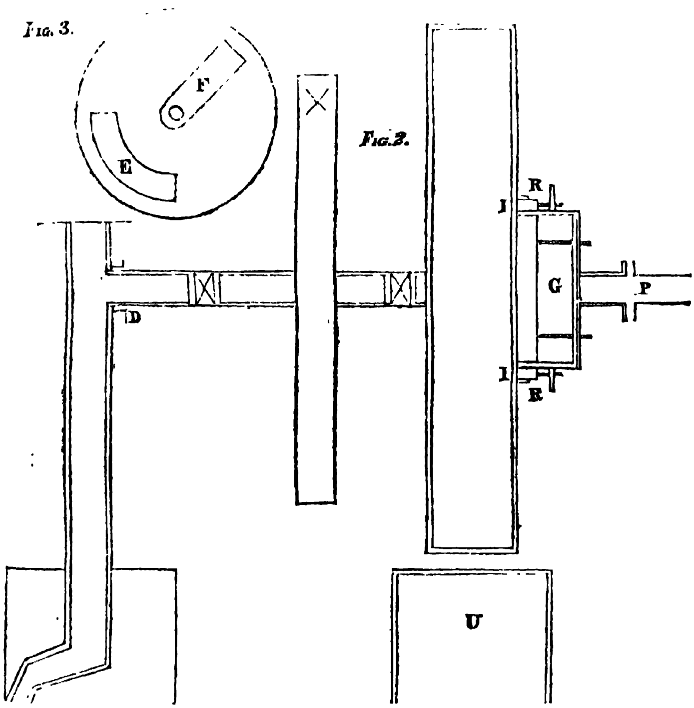
Description.

Fig. 1 is a side-view of the wheel, the rim of which is hollow; at equal distances, marked *ooo*, are openings through both sides of the wheel, into which are introduced brass cases, well fitted and secured, for brass cocks to move in. The arms of the wheel are hollow also, and into each is a separate opening, as at *aa*, communicating with the rim; the circular part, *bb*, is turned true on the face; at C is a perforation through the axis, the other end of which works in a stuffing-box at D, fig. 2, within the condenser. Fig. 3 is a strong brass washer, turned true on the face and edge; at E there is an opening

quite through; the space marked at F is only an indented archway, through which (when the washer is brought against the face of the wheel to the corresponding dotted spaces and letters) the steam escapes into the condenser. The round metal box, G, fig. 2, is turned true on the inside, and into it is introduced the above washer, which is closed against the face of the wheel by screws through the back side of the box, communicating with the boiler by pipe P. At RR are flanches on the box, G, and also on the wheel, at I; into a recess, against the wheel, a skin is pressed by a hoop-plate round the box, G, by screws through the flanch on the box, to secure the face air-tight. At fig. 4 are the band-geering. Instead of water, I propose making use of oil, as there is no waste. U, fig. 2, is a cistern containing oil, by sending the fluid to or from which the machine may be regulated to different powers; the cocks on the edge of the wheel will empty into the cistern, and by the same means steam may be put into the wheel. At X, fig. 2, is a tooth-wheel, round which is a brush, similar to a wind-mill.

Fig. 3.

Fig. 2.

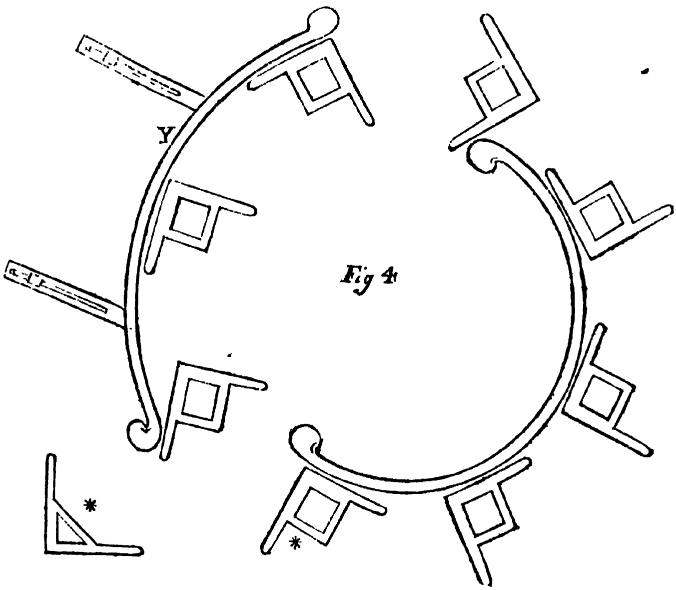


The operation is as follows:—Supposing the machine to have been at work, all the cocks would be shut on the rising side, which must now be opened; slide back the guide-plate at Y, fig. 4, and open the cocks, and the whole space on the top of the wheel above the fluid, marked by a dotted line, L L, fig. 1, will be open; put on the steam, and open the cocks on the edge of the wheel, to let out the air; close the cocks, and condense the steam. There is now a vacuum formed in the top of the wheel; close the cocks at Y, fig. 4, and adjust the guide-plate; again put on the steam, and the fluid will rise in the wheel in the direction shown by the arrows; open the condenser and take off the brake; the steam will now press the fluid in succession into the vacant spaces in the top part of the wheel, where a vacuum is regularly forming, as they pass the opening to the condenser on the rising side. I conceive the friction to be trifling to what one might imagine from a superficial view, by reason of those parts being constantly enveloped with oil. I calculate upon a very slow motion, not to exceed a space of one foot per second.

I am, Sir, your humble servant,

A Yorkshire Miller.

Near Barnsby, Dec. 15th, 1824.



P. S. If you think it can be rendered useful, I would thank you, or any of your able Correspondents, to give the effective power of this machine by fluid alone, when filled to one foot beneath the centre. The given dimensions are—diameter 12 feet, the rim two feet square, arms 3 inches by 24, and length two feet six inches (within), and the size of a boiler adequate to supply it with steam; also what power the steam adds to the machine, in addition to forcing the steam into the vacuum, and furnishing means for that vacuum, according to the speed before hinted at.

CLOCK WITHOUT WHEELS.

Sir,—From the effects of custom and the association of ideas, they returning daily in the same order, it rarely occurs, in the ordinary concerns of life, that more than a superficial review of things is taken by the mind at the mention or even sight of what daily comes under notice, although much science and great ingenuity may be connected with it. Thus the barometer is hung up in almost every house, and constantly inspected by thousands, who are no more excited to inquire after its cause and modes of action, than about the circulation of the blood in their own body; they consider it, and all that belongs to it, but unity of material, as much as the poker at the fireside. The clock, in like manner, has its machinery treated as almost a hidden mystery, or as if it had the power of creating time by its wheels; the cumbersome weights, which are the life and power of the whole, scarcely ever inducing one rational idea to be passed upon them, or other than that the clock will not go without them.

Now, Sir, I wish to call the attention of some of your ingenious readers and writers on mechanics, respecting these same neglected weights, to know from them if it be not possible to do away with Messrs. Wheel and Co. altogether.

The principle I go upon is, that any thing in a state of constant and uniform motion indicates time, however clumsy its construction may be, as well as the most delicate and sightly piece of mechanism. The equal and alternate motion of a rocking stone,

were it possible for one to move of itself, could not be exceeded as a time-keeper by the best chronometer; and, as power and motion are always coincidental, indices could always be attached where these exist, for the purpose of showing greater and less periods of time. The clock-weight may be considered in the light of a self-moving power, and the principal use of all the machinery of the clock-work is only to regulate the descent of the weight. Query—Is it not possible to cause a weight of this kind to fall equably, and with no greater velocity than that of a clock-weight, without the host of complicated appendages which go towards the construction of a clock? and if so, how much simpler, more independent of change by weather and climate, and more correct for astronomical calculations, would not such a time-keeper be for the study and the laboratory than any clock now in use?

As the machinery of a clock retards the weight, and makes it descend equably, it is possible to get a falling body under this species of control; and were the cord attached to a falling body, wound round a revolving cylinder only, the descent would be retarded, and more so were it wound round two such cylinders: the medium the weight might be made to fall in, would also retard the motion; and even in air advantage could be taken of the extent of surface and shape of the weight. Many contrivances, it is presumable, could be resorted to for the purpose, which the mechanist is well aware of, to regulate the descent and limit the space; while an index-hand, projecting from any part of the weight, and pointing to a scale situated vertically beside it, would tell hours and minutes as correctly as the hands of a clock. To avoid the errors in time attendant on drawing up the weight, any watch, beating seconds, would give the number of seconds on the index, to which alone, of the entire scale, the gnomen should be drawn up to.

Should these speculations not be unworthy a place in the Mechanics' Magazine (to which I am indebted for much information), your giving them publicity in one of its pages will oblige your constant reader,

C. D. Y.

November 20th, 1824.

RAIL-ROADS.

Sir,—In No. 76, page 308, your Correspondent (J. Y.) endeavours to remove a doubt of mine, communicated in No. 73, but his observations do not apply to the subject. I am well aware that upwards and downwards are merely relative terms, and that a body continually impelled in any direction whatever, by any given force, will continually increase in velocity, just the same as the motion of a falling body is accelerated by the constant action of the power of gravitation upon it: but what puzzled me simply related to friction. However, from a more attentive perusal of the Treatise upon Railways, and from what is contained in the succeeding Number to that which occasioned my difficulty, I now acknowledge that I was under an erroneous impression; for, in No. 72, it is stated that the friction is equal in equal times, and, therefore, if the wheels of a carriage make sixty evolutions in a minute, there will be no more friction in that time than if they make only thirty, or twenty, or any other number of revolutions, in a minute; from which it is evident that the friction of each revolution diminishes in the same proportion as the velocity increases. If this be true (and I think, from what has been said in your interesting Magazine, there is great probability of its being so), then the power required to impel a carriage on a level road or railway, will be in proportion to the time, let the velocity be what it may.

I remain, Sir,
Your obedient servant,
G. W.

Norwich, Feb. 10th, 1825.

WHEEL CARRIAGES.

Sir,—I met with, very lately, a specification of a patent obtained by

Mr. Ackerman, five or six years ago, for an improvement in four-wheeled carriages. The invention appeared to be of German origin. It consisted in an application of the axles of the fore-wheels in such a manner that the lower carriage (to which, by the common mode, the fore-wheels are attached) is totally unnecessary, and offering apparently considerable advantages in not only rendering the draught easier, by permitting the fore-wheels to be of greater diameter, but by placing the "line of draught" nearer to the axis than is practicable by the old method. In addition to these improvements, the patentee contemplated a reduction in the weight of the carriage, and also an increased security, from the points of bearing on the ground being much nearer to the centre of gravity in case of turning the carriage. As I am building a chariot to run in a very hilly country, and over bad roads, I am anxious to adopt any improvement that may be advantageous; and should any one of your numerous readers have put the above alterations to the test of practice, I should feel much obliged by a candid opinion as to their merits or otherwise. I presume that their adoption in the metropolis would be a matter of course, were the patentee borne out in all the advantages he promises by the test of experience.

I am, Sir, yours, &c.

FORE-WHEEL.

Leeds, Feb. 5th, 1825.

SOUR BEER.

SIR,—The smallest chemical process for the preservation of beer, cyder, &c. from becoming flat, and thence acid, must be inconvenient to servants; but the views of Mr. Joyce may be much more simply attained by placing in any cask of cyder, beer, &c. which may be subject to become acid, some pieces of whitening or purified chalk in muslin bags. If acid formed, it would act upon chalk; carbonic acid would be evolved, as Mr. Joyce proposes, which would make the drink pleasant, while it preserved it also, and the alkali of the chalk would correct the acid precisely in the degree in which it formed, "of which the point of saturation," Mr. Joyce expresses, "is attended with no small difficulty." Chalk does not dissolve unless brought into action by the presence of acid, and it cannot, therefore, be made use of in excess, or prove injurious to the kidneys, in the manner of all the other alkalis. All hard water contains a solution of lime, and hence, taking Nature as a guide, there cannot be either trouble, uncertainty, or danger, from such a practice.

I am, Sir,

Your obedient servant,

TYRO.

CHLORINE.

SIR,—Having my pen in my hand, I will inquire, through your Magazine, whether the formation of Chlorine Gas does not take place on mixing oxide of manganese with muriatic acid, in consequence of the metal giving out its oxygen to form water with the hydrogen of the muriatic acid? I asked a chemical gentleman this question, when he replied that he was not aware the formation of chlorine could be so easily and clearly accounted for; but he did once pass the muriatic acid gas, in a dry state, over oxide of manganese and chlorine formed as in the common method of applying the oxide to the liquid acid. The lamp of Professor Dobereiner acts in this manner. Platinum (spongy) is found to have the power of causing a current of hydrogen gas, passing upon it, to unite with the oxygen of the atmosphere. It has also been applied by Dr. Turner, of Edinburgh, in this manner, and found most useful for all purposes of eudiometry. The gentleman above alluded to had no opportunity of perceiving whether there was any light produced in the experiment, which would at once decide the question. Such an explanation, if it can be proved to be accurate, would clear up much uncertainty in chemical science.

* * * *.

Temple of Tyromancy.

PROFIT AND DISCOUNT.

SIR,—In my last communication I promised to send, for insertion in your valuable miscellany, a few rules relating to Profit and Discount; I now beg to submit for publication the following rules, which are quite new, as far as I know.

Let C represent the sum the goods cost,
S the sum sold for,
R the rate of profit,
D the rate of discount.

Then it is evident that CR will represent the profit, and $\overline{C+CR}$ will be the amount of the cost and profit, and SD will represent the discount; therefore $\overline{S-SD}$ will be the amount remaining after the discount is taken from the sum sold for. Now, as this last (S—SD) will leave the cost and profit, it is evident that $\overline{C+CR}$ must be equal to $\overline{S-SD}$, or $C+CR=S-SD$. From this Equation the four following rules are easily derived:—

Rule 1st - - $\dfrac{\overline{R+1}\times C}{1-D}=S$, or $\overline{1-D} : \overline{R+1} :: C : S$.

Rule 2nd - - $\dfrac{\overline{1-D}\times S-C}{C}=R$, or $C : \overline{\overline{1-D}\times S}-C :: 1 : R$.

Rule 3rd - - $\dfrac{\overline{1-D}\times S}{R+1}=C$, or $\overline{R+1} : \overline{1-D} :: S : C$.

Rule 4th - - $\dfrac{S-\overline{R+1}\times C}{S}=D$, or $S : S-\overline{R+1}\times C :: 1 : D$.

As all your readers may not understand the rules expressed in the above characters, I shall set them down in the common manner as plainly as I am able.

1st Rule.—As the difference between unity and the rate of discount is to the amount of unity added to the rate of profit, so is the cost price to the selling price.

2nd Rule.—As the cost price is to the difference between the cost price and the product arising by multiplying the sum at which the sale must be made by the difference between unity and the rate of discount, so is unity to the rate of profit.

3rd Rule.—As the amount of unity added to the rate of profit is to the difference between unity and the rate of discount, so is the selling price to the cost price.

4th Rule.—As the selling price is to the difference between the selling price and the product arising by multiplying the cost price by the sum of the rate of profit added to unity, so is unity to the rate of discount.

Perhaps an Example may be deemed necessary; therefore, first, suppose an article cost 50*l*., on which it is wished to make 7½ per cent. profit, what must the selling price be so as to be able to allow 3 per cent. discount?

By using the first rule it will appear that 55.412, &c. or 55*l*. 8*s*. 2¾*d*. is the sum at which the article must be sold; for $\dfrac{\overline{1+.075}\times 50}{1-.03}=55.412$, &c. the selling price.

I would give an Example to each of the Rules, but I should, perhaps, be occupying too much of your columns, and therefore leave the reader to his amusement in his own way.

I remain, Sir, yours, &c.

M. W.

Fenchurch-street, Jan. 3, 1825.

ON THE STRENGTH OF ROPES.

BY M. DE REAUMUR.

(*Concluded from our last.*)

EXPERIMENT 5.—I made a cord of six threads; it ought at least to have sustained 36lbs. if the strength had been equal to that of the sum of the threads, and this cord broke with a weight of 31 lbs.

EXPERIMENT 6.—A cord of ten threads, very well twisted, which should at least have sustained 60 lbs., if its force had not been less than that of the sum of the threads, broke on being charged with 50lbs.

EXPERIMENT 7.—Having made a cord, by doubling the longest of the two ends, which I had left of the preceding cord, as it was composed of ten threads; we

see that I made a cord of twenty threads, which could not carry less than 120 lbs. without being weaker than the sum of the threads, and ought to carry 100 lbs, if its strength was not diminished by the last twisting. A weight of 80 lbs. broke this cord; its strength was therefore diminished by the last twisting.

EXPERIMENT 8.—Another cord, of 28 threads, which would at least have borne 168 lbs if the twisting had not diminished the strength of the cord, was broken by a weight of 82 lbs. I made several other experiments, which had the same results, and which, therefore, it would be useless to state. Lest it may be imagined that the cords which I made were too much or too little twisted, and that perhaps the same effect does not happen with the cords of thread or hemp made by the rope-makers, I made a trial of these last. Among the various experiments which I tried on them, I shall content myself with relating the two following, because all the others have had similar results.

EXPERIMENT 9.—I took a small hempen cord, very well made by a rope-maker; it consisted of three other smaller cords, each of which was composed of two coarse threads of hemp; I call those threads which are not made of other smaller cords, but are composed of divers filaments of hemp or flax; having fixed a weight of 50 lbs. to the cord just mentioned, it broke in an instant. As it seemed to me that this cord ought to have been stronger, I suspended afterwards several weights to the longest end that was left; it sustained 72 lbs., and broke on being charged with 75 lbs. To know if the sum of the forces of the three little cords which composed it was greater than its strength, I untwisted it, and having tried the strength of these little cords by different weights, I found that one bore 27 lbs. without breaking, the other 33 lbs., and the last 35 lbs.; the sum of the strength of these three cords was therefore at least equal to that which is required to a weight of 95 lbs, yet the cord which they composed had first broken at 50 lbs., and afterwards at 75 lbs.—its strength was therefore much less than that of the sum of the threads. As to the rest, it must be observed, that if I had sought the strength of the two threads which each of the three little cords was composed of, the sum of the forces of these two threads would perhaps have been found less than that of the little cord which they composed; and that, by a reason particular to cords which are made of filaments shorter than the cords themselves, which is, that each of the filaments cannot exercise its whole strength, unless the resistance of the friction, which it must overcome to slip, does not surpass the power which this filament has to sustain a weight. Now it often happens that the threads are not enough twisted, because the filaments of hemp or flax which compose them cannot slip so easily as not to be broken; but when we make a cord, for example, with two or three of these threads, the new twisting which is given them adds to the filaments which compose them what they want of friction, and allows them to be broken by a less force than is necessary to make them slide, each filament being more easily broken than disengaged from those which encompass it. The strength of a twisted cord will always be less than the sum of the forces of the threads or filaments which compose it.

EXPERIMENT 10.—Another cord, pretty near the same thickness with the preceding, will also serve for a new proof. It sustained a weight of 70 lbs., and broke about the middle by a weight of 72 lbs. I fastened a weight of 75 lbs. to the longest bit that remained, to see if the cord had not broken in a place much weaker than the rest; but it could not sustain the weight of 75 lbs. Having sought separately the strength of the three little cords of which it was made, the first bore 24 lbs., and broke with 28 lbs.; the second bore 28 lbs., and broke with 29 lbs.; the third sustained 30 lbs., and broke with 31 lbs. The sum of the strength of these three little cords was, therefore, at least equal to 82 lbs., and consequently greater than that of the cord made of them by a weight of 71 lbs.

There is no doubt but that the experiments which I made would have succeeded in the same manner upon thicker cords; the greater number of threads, or of small cords, cannot make any alteration; but the experiments would have been much more difficult to execute, and the preceding are sufficient. I shall, however, relate one which I made with a bit of silk, such as is commonly used for sewing; notwithstanding the smallness of this sort of cords, we may compare it to the thickest cables, if we only consider the number of single threads which compose it. The threads of this bit of silk were exceedingly fine; it also contained a much greater number of filaments than the bits which I have spoken of in the "Examination of the Silk of Spiders;" for having separated it with great attention and patience, I divided it into 832 single threads, whereas I never found but 200 threads in the others. If there were any mistake in this calculation, it could be only in making the number of threads less than it really was, because it might easily happen that the extreme fineness of these threads might make me sometimes take two for one; but this number cannot be too great, because I never counted one thread without separating it well from

the others; I had also the precaution to cut it after having counted it, for fear I should make a double work of it. These 832 threads composed two different little cords, which being twisted about one another, made the bit of silk. Having successively fixed different weights to this bit of silk, I found that it commonly sustained 5lbs. for some moments, after which it broke; but it was seldom strong enough to bear 5½ lbs., and in a great number of experiments it was not above once or twice that 5½ lbs. did not break it. Having afterwards examined the strength of the threads which composed this piece of silk, I was convinced, by several experiments, that the weakest could sustain a drachm without breaking, and the strongest a drachm and a half. We see therefore, that if these threads are much finer than those which I spoke of in the "Examination of the Silk of Spiders," they are also much weaker, for those sustained two drachms and a half. Since these threads bore at least a drachm, and the strongest—of which I found a much greater number than of the weakest—bore a drachm and a half, it is evident that I am not too favourable to the sum of the forces of the thread, when I take one drachm and 18 grains for the mean force of each thread; and, according to this supposition, the sum of the forces of the thread which compose this piece of silk was 1040 drachms; or, dividing this sum by 128, to reduce it into pounds, the sum of the forces of the threads was 8lbs. 2oz. Now we have seen above, that the silk did not, in general, sustain above 5 lbs., and but seldom 5½ lbs.; its force was, therefore, considerably less than the sum of the threads. If we had taken the force of the weakest threads, which was a drachm, for the true force of each thread, the sum of the forces would have been 832 drachms, that is, 6½lbs., and consequently greater than that of the bit of silk.

We may, therefore, certainly conclude, from all these experiments, that the force of a twisted cord is less than the sum of the forces of the threads which compose it; but it is not possible to determine in what proportion the twisting diminishes it, because this diminution depends upon a great number of irregularities, each of which may be combined in many different manners. These experiments teach us, at least, that when we can employ, in a convenient manner, many little cords, and can stretch them equally, these little cords would be in a state of producing a greater effect, or of resisting a greater effort, than a cable composed of all these small cords would be. Lastly, if we cannot decide what the strength of a cable is, we may decide what are the limits of its strength, by seeking what the force of one of the small cords is which compose it, and by examining what is the number of these cords; since we have seen that the force of the cable is less than the sum of the forces of all these cords.

A HINT TO PUBLISHERS.

Sir,—In the course of reading foreign works I have found considerable convenience in the mode almost universally adopted abroad, of attaching maps and plans by blank leaves, so that the edges of the maps and plans may be clear of the leaves and cover, whether the book be open or shut. This mode is rarely followed in this country; but, with all respect for the judgment of publishers, I venture to give my humble opinion that readers in general would be very considerably convenienced by the adoption of such trifling alteration. You, Sir, must have often observed that this mode gives the reader the full use of every part of a map or plan, without the continual occasion for lifting the leaves, and even without opening the volume.

Accept my best acknowledgments for the pleasure and useful knowledge received through your valuable Magazine, by

Your constant reader,

Z.

MORTARS.

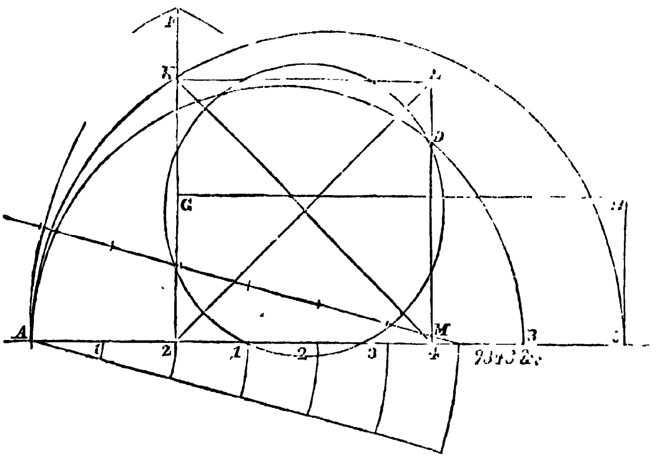
Sir,—Being engaged in a subject interesting to Mechanics—the study of Calcareous Cements, I should feel obliged if you would communicate to your numerous readers my wish to possess a few specimens of ancient Mortar, of extreme hardness, and which must be such as to resist any impression of the finger-nail. The size of an apple will be quite sufficient, and if any are sent that are interesting, a correct analysis shall soon be sent of their properties, for insertion in your useful work.

I am, Sir,

Your constant reader,

A Subscriber.

EXTRACTION OF THE SQUARE ROOT



Sir,—The diameter and periphery of a circle, with the side of a square which shall be equal in area to the circle, are lines incommensurable to each other; it would be therefore quite a hopeless speculation to attempt expressing their proportions in our common arithmetical notation. The decimal fraction, 3,141592653589, &c. has been carried on to thirty-six places of decimals by the celebrated Van Culen, in his attempt to find the length of the periphery of a circle, the diameter of which is unity; but, if he had continued his extractions until they equalled in length the diameter of the orbit of Saturn, the fraction would still be but an approximation to the truth.

Permit me to lay before you a diagram, which, if perfect, would give, if not the exact truth, the nearest approximation to it yet made. Being a young geometrician, it may be presumption to aspire to perfection, but such is the idea I would wish to inculcate.

If we take the fraction alluded to, namely, 3,14159265359, and multiply it by itself, a part of the product will be a surd number, the true square root of which can never be extracted perfectly by any arithmetical process, the product will be 9,869604401090657739881.

Observe, the terminating figure of the original fraction above is too great, being substituted for 89, which would be minus; therefore, as the root is greater than truth, the square must also be greater; let us cut off the ten decimals on the right hand, and retaining those on the left, let us extract the square root.

9,86,96,04,40,10,90 (3,14159265
61 . 86
624 2596
6281 10004
62825 372340
628309 5821510
6283182 16672990
62831816 410662600
628318525 3367152400
225559775

We have now obtained nine figures of the root with a remainder which would give the next quotient figure greater than 3, if we could express it. We are now as much at a loss as ever to express the length of the periphery in arithmetical terms; but we are told by Euclid, that a perpendicular let fall from any point in the periphery of a semicircle, will be a mean proportional between the two segments into which the diameter is divided by the intersection of the perpendicular. Now, we have every reason to think that 9,8696044090 is the true quantity, the square root of which is the periphery of a circle which has unity for its diameter.

Let us divide

$\frac{9,8696044090}{2}=4,9348022045$: now, on reference to our diagram, we find the line AB the diameter of a semicircle, and it is divided at E into 2 + 4,9348022045; and from the point F, in the periphery, is let fall the perpendicular line FE, dividing the diameter into two segments; therefore the perpendicular EF is the true geometrical mean proportional between the two segments, or, in other words, the true and perfect square root of their product 9,8696044090, which, if we attempt to extract arithmetically, we shall obtain a circulating decimal which can never terminate.

We have now, in the perpendicular line EF, the rectilineal magnitude of the periphery of a circle, the diameter of which is unity, and we have that unit in one of the six equal parts into which a portion of the diameter is divided, of which AE is two, therefore two diameters; the parallelogram, EGHI, has two peripheries in length, and its altitude is two diameters, therefore its area is equal to that of the circle which has four for its diameter; for half the diameter, multiplied by half the periphery, gives the area of the circle.

We learn also from Euclid, that if we produce the base of a parallelogram, and add to it its altitude, then bisecting the whole line, and making one half of it radius, describe a semicircle, the periphery shall cut a perpendicular line raised at the point of junction of the base and altitude, which line (EK, so cut at K) shall be the side of a square equal in area to the parallelogram. By such means the square, EKLM, has been formed, and therefore may be demonstrated to be equal to the parallelogram; but the parallelogram was made equal to the circle by construction, therefore the square is equal to the circle. If we multiply the square of the diameter by one-fourth of the periphery of unity, we obtain the area of the circle; therefore,

$$\frac{3,14159265}{4} = ,7853981625,$$

$$7853981625 \times 16 = 12,5663706 = \text{area of circle},$$

$$\text{2 peri. } 6,28318530 \times 2 \text{ diam.} = 12,5663706 = \text{area of parallelogram},$$

$$\text{side } 3,544 + \times 3544 + \quad = 12,5663706 = \text{area of square}.$$

The radius of the circle is 2; the diameter 4.

I fear I have worn out your patience, but hope that I have made myself understood. Should you deem this effusion of an untaught philosopher worthy a place in your very useful publication, I should feel pleasure in seeing my humble name appear as one of your contributors.

I trust some of your enlightened Correspondents will favour us with their opinions.

RICHARD DOWDEN.

Cork, September 1, 1824.

SAND CLOCK.

SIR,—A Correspondent in your 74th Number, subscribing himself C. D. W + 8, and dating his letter Parsondrove, Nov. 5th, 1824, gives a drawing and description of a Sand Clock. If he would favour your readers with the length and diameter of the tube, stating whether wood or metal was preferable; if the latter, whether tin would answer; the size of the cone, and if necessarily of that shape; the length of time the

sand is in running out; how many ounces the weight should consist of; the length of the cord; and how both are adjusted so as to keep correct time—he will greatly oblige

Your constant reader,

A Yorkshire Mechanic.

February 5th, 1825.

ON A MODIFICATION OF DOCTOR BREWSTER'S PROTRACTOR.

BY MR. DAVIES.

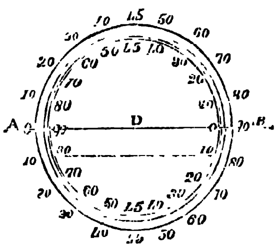
In a Letter to the Editor of the Mechanics' Magazine.

Sir,—It was not till a very short time ago that I was aware of Dr. Brewster's having noticed the circular, instead of the semicircular Instrument for measuring and laying down angles. I had previously believed that the thought, simple as it was, *originated* with myself; though it must be confessed, that my being almost in the daily habit of using Leslie's Geometry, in which a similar instrument is mentioned (p. 321, 4th Edit.), seems very likely to have been my real authority. However, be that as it may, the more important consideration to the public is the utility of this, in preference to other protractors, and the best and most facile method of using it. I think the following method will be found in some respects preferable to Dr. Brewster's;* and as I have never seen it brought into use, nor even described in any work which is at all likely to come before the greater portion of your readers, you will, I think, be doing some service by publishing an account of it in your truly useful Magazine.

Description of the Instrument.

The first figure represents the instrument. ADB is the diameter, and D the centre of the ring. The rim is divided into two concentric circles, for the purpose of containing the numbers of its graduations, which run in a reverse order to each other. The inner ring has its graduations numbered, from B *upwards* and *downwards*, and the outer ring from A, also *upwards* and *downwards*. The whole circumference being divided into 180° instead of 360°, we shall have 90° at A on the inner ring, and 90° at B on the outer ring, and 45° upon both rings, where a diameter perpendicular to AB cuts them. In our diagram we have only numbered every ten degrees, and marked every five. This will suffice to show the principle, and to render the application of the instrument intelligible to every one.

Fig. 1.



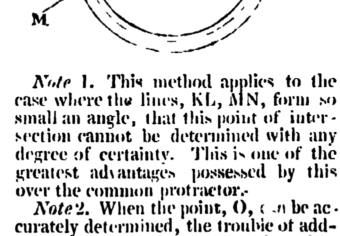
USE.

PROBLEM I.

To measure a given angle.

Case 1.—When the lines actually meet, as KL, MN, fig. 2, place the diameter of the instrument so that it shall coincide with either of the lines (in our illustrations we shall take the line which *dips towards the right* in the diagram), as KL; add the numbers comprised between BS on the inner ring, and between AT on the outer ring; the sum will give the magnitude of the angle.

Fig. 2.



Note 1. This method applies to the case where the lines, KL, MN, form so small an angle, that this point of intersection cannot be determined with any degree of certainty. This is one of the greatest advantages possessed by this over the common protractor.

Note 2. When the point, O, can be accurately determined, the trouble of adding may be avoided, by putting the point, A, of the instrument, upon the point, O, of the diagram; BS, on the inner ring, will then give the magnitude of the angle.

Note 3. When, however, the angle approaches to a right angle, the method of

* Treatise on New Philosophical Instruments, 8vo. Edin. 1813.

taking the sum of the two arcs, AT and BS, is to be preferred.

CASE 2.—When the lines, KL, MN, do not meet, as in fig. 3.

Place the diameter upon KL, as before. Take the *difference* between the arcs AT, BS; the former measured upon the outer, the latter upon the inner scale.

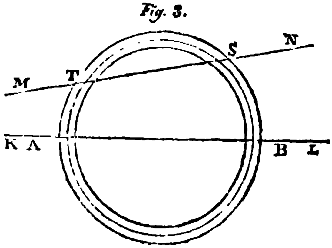
Note. This mode of taking the measure of the angle will be highly useful in most of the arts where accurate drawing is of essential consequence.

PROBLEM II.

Through a given point to draw a line which shall make a given angle with a given line.

Let S, figs. 2 and 3, be the given point, and KL the given line.

Fig. 3.

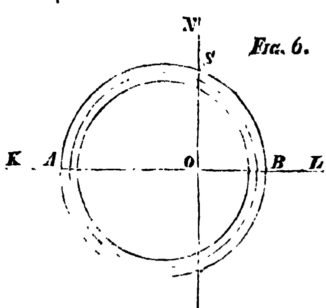


Place the diameter, AB, of the instrument upon KL, so that the circumference shall touch the given points. Then,

CASE 1.—If SB, upon the *inner* scale, be *less* than the measure of the given angle, count AY upon the outer scale, equal to the *deficiency*, and mark the point, T, upon your paper. The line, ST, being drawn, will be that required (fig. 2.)

CASE 2.—If SB, upon the outer ring, be *greater* than the given angle, mark its *excess*, AT, upon the outer (fig. 3); the ST, as before, will be the direction of the required line.

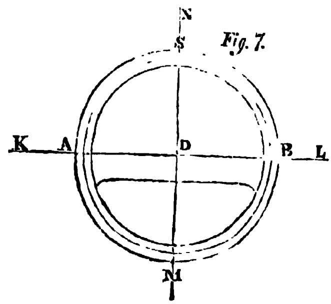
Fig. 6.



Note 1. When the required angle is right, or we are required to raise a perpendicular to a given line, which shall pass through a given point, the instrument is very useful. For, fig. 6, we have only to make BT equal to BS, and ST is the perpendicular required. The intelligent artisan will see that this is only a modification of our last case.

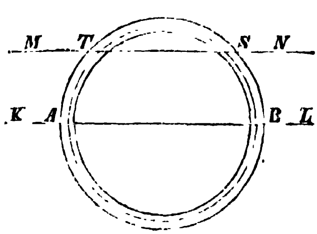
Note 2. If the point through which the perpendicular is to pass is *in* the given line, the same method which is adapted to the common or semicircular protractor applies. Bring the centre, D, (fig. 7) to the given point, and the perpendicular will pass through the point marked 45 upon the scale.

Fig. 7.



Note 3. To draw a parallel to a given line, which shall pass through a given point, is a problem effected with the same case. It is, in fact, identical with the solution of the same problem by the common protractor, and the method will be obvious from an inspection of fig. 4, where KL is the given line, and S or T the given point.

Fig. 4.



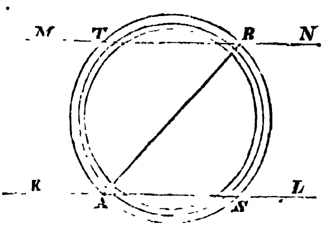
CASE 2.—If the point through which the perpendicular is to pass be situated beyond the reach of the instrument, when its diameter coincides with the line KL, this method may be adopted.

Place one end, B (fig. 5), of the diameter in the given point, and bring the other end, A, to cut in the given line; take the arc BT equal to the arc AS, cut off by KL; then BT being drawn will be parallel to KL.

CASE 3.—If the given point be *in* the given line, we have merely to place the

point, A, of the instrument upon the given point, and note the point where the degree required of the instrument touches the paper; the line drawn from A through that point is the one required. This is too obvious to need a diagram.

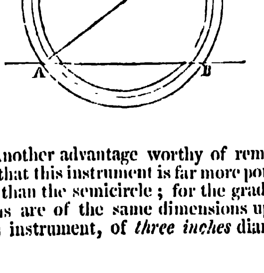
Fig. 5.



Having thus shown the construction and use of the instrument, it may not be unappropriate to make a few remarks upon the different forms which are given to instruments for the same purpose.

The first in order of comparison is the common semicircle. Its chief advantages over that instrument are in its adaptation to cases where the lines are nearly parallel, or the angle of inclination very small, and where the lines do not meet within a conveniently accessible distance. The case of drawing a perpendicular to a given line, and passing through a given point above or below that line, may be constructed by the *semicircular*, though not quite so conveniently as by that we have described above. The method will be obvious enough by what has been said in your Course of "MECHANICAL GEOMETRY." Lay the instrument, fig. 8, with one extremity in the given point, C, and bring the other, A, upon the given line; the semicircular ring will cut the line in another point, B, which is the foot of the required perpendicular.

Fig. 8.



Another advantage worthy of remark is, that this instrument is far more portable than the semicircle; for the graduations are of the same dimensions upon this instrument, of *three inches* diameter, as they are upon a semicircle of *six inches* diameter; it is, therefore, better fitted for a common case of instruments.

The next comparison is with the protractor laid down upon the parallelogram, generally at the back of the plain scale. The neatness of its appearance seems to have been the principal incentive to the adoption of this form. The greater magnitude of the divisions *near the ends*, if it were not more than compensated by the *less magnitude* of those near the middle, would certainly be so by the difficulty of *marking an oblique line* from that scale, and of avoiding the *variation* in the system of errors arising from that source. Nor can any certain *estimate* be made by this instrument of the halves or thirds of a division—a defect from which the circular instruments are also free.

The last comparison we shall at present make will be with Jordan's Pannetron—not, indeed, that we think Dr. Brewster's instrument can supply the place of protractor, parallel ruler, and sector—in short, with the aid of a pair of compasses, supply the place of a complete case of instruments. The objections urged against the parallelogram may be urged with equal propriety against this instrument. What advantage can be derived from transferring the trigonometric lines from a parallelogram to a triangle, I am unable to discover; and, still more so, as the sides of the triangular instrument, upon which these lines are marked, are themselves unequal. In short, there is not a single problem which can be performed by this instrument which cannot be performed by a common Gunter; if, indeed, we except that of drawing parallel lines, which, however, is not new, being known long since in our military schools and most surveyors' offices. The method, indeed, is but an application of Marquoi's parallel scales to the simplest purpose for which they were *originally intended*. The great advantage, too, of the sector (*its invariable reading*) is overlooked entirely in the Pannetron.

What peculiar excellence the patrons of this contrivance saw in it, I must confess my inability to discover; but any of your readers who can supply my "lack of wit," will confer a favour upon me by entering fairly into the discussion.

I remain, Sir,
Your most obedient servant,

Bath, Nov. 29th, 1824. T. S. D.

P.S. May not the mode of describing arcs of circles, of which the *radii are large*, noticed in your Magazine, suggest an instrument for effecting that purpose upon paper, so as to be of great use to those artists who are connected with the construction of maps? I am sure such an instrument would be of great utility in schools, and may be made at a

small expense. Any of your readers who are at all engaged in the mathematical instrument business, would find it worth their while to turn their attention to it.

T. S. D.

STANDARD FOR LINEAL MEASURE.

Sir,—In the 73d Number of the *Mechanics' Magazine*, p. 271, there is a very good paper, by Mr. Pasely, on the importance of obtaining a natural Standard of Lineal Measure, which is certainly well calculated to answer the end designed by its authors. But the method which he suggests for that purpose cannot be new. I think it must have been tried, and was not found to be so correct in practice as the one by the pendulum; for we cannot suppose that our scientific men have made so many experiments with the pendulum, and have not tried this method, when they can very easily obtain, by mathematical calculations, the space that a heavy body would fall through, by the force of gravity, in vacuo, in a given time—a second, for instance—by knowing the length of a pendulum vibrating seconds, at the same place, *et vice versâ*. I say, at the same place, because the force of gravity varies with the latitude; and a standard obtained by either of the above methods at London would not be of the same length with one obtained by a pendulum making the same number of vibrations, or by the space that a heavy body would fall through in the same time at the Poles, as the force of gravity continually increases from the Equator to the Poles, where, I suppose, it is a maximum. Hence we see that a standard obtained by the above methods is not universal, but confined to a certain place, and that the variations of a degree in latitude would not make much difference.

The French academicians obtained their standard by measuring the meridian, and taking for that purpose the forty-millionth part of it, which they call a *metre*, from which all the measures and weights of the French nation are deduced. This quite contradicts the assertion, that "motion alone presents the only means of obtaining a lineal standard which is founded in nature." Perhaps the following results of computations and experiments* may be useful to some of your numerous readers:—

The pendulum vibrating seconds of mean solar time at London, in a vacuum, and reduced to the level of the sea, is 39.1393 inches; *consequently the descent of a heavy body, from within one second of time, in a vacuum, will be* 193,145 *inches.*

A platina metre, at the temperature of 32°, supposed to be the ten-millionth part of the quadrant of the meridian, 39.3708 inches, the ratio to the imperial measure of three feet, as 1.09363 to 1.

The five following standards, accurately measured, give these results:—General Lambton's scale, used in the Trig. Surv. of India, 35.99934 inches. Sir G. Shuckburgh's scale (which, for all purposes, may be considered as identical with the imperial standard), 35.99998 inches. General Roy's scale, 36.00088 inches. Royal Society Standard, 36.00135. In Ramsden's bar., 36.00249 inches.

Weight of a cubic inch of distilled water in a vacuum, at the temperature of 62°, as opposed to brass weights in a vacuum also, 252.722 grains; consequently, a cubic foot 62.3862 pounds avoirdupois. Weight of a cubic inch of distilled water in air, at 62° of temperature, with a mean height of the barometer, 252.456 grains; consequently, a cubic foot 62.3206 pounds avoirdupois; and an ounce of water, 1.73298 cubic inches. Cubic inches in the imperial gallon, 277.276. Diameter of the cylinder containing a gallon, at one inch high, 18.78933. Specific gravity of water at different temperatures, that at 62° being taken as unity:—

70°	0.99913	64°	0.99980	56°	1.00050	50°	1.00087	44°	1.00107
68	0.99936	62	1.	54	1.00064	48	1.00095	42	1.00111
66	0.99958	58	1.00035	52	1.00076	46	1.00102	40	1.00113
								38	1.00113

The difference of temperature between 62° and 39°, when water attains its greatest density, will vary the bulk of a gallon of water rather less than the third of a cubic inch; and assuming, from the mean of numerous estimates, the expansion of brass 0.00001044, for each degree of Fahrenheit's thermometer, the difference of temperature, from 62° to 39°, will vary the contents of a brass gallon measure just one-fifth of a cubic inch. It appears that the specific gravity of clear water from the Thames exceeds that of distilled water, at the mean temperature, in the proportion of 1.0006 to 1, making a difference of about one-sixth of a cubic inch on a gallon. Rain water does not differ from distilled water, so as to require any allowance for common purposes.

By inserting the above in your useful Magazine, you will oblige,

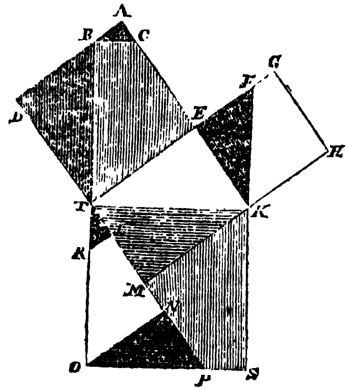
Sir, your obedient servant,

W. LAKE.

Balbourne, near Tring,
Feb. 5th, 1825.

* Extracted from the Imperial Almanack.

FORTY-SEVENTH PROPOSITION OF EUCLID.



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R. W. Bloxam.

Isle of Wight, Nov. 21st.

Cut off DB equal to EK, join BT; draw from the point B BC perpendicular to BT; produce SK to F, DT to P, and HK to M; cut off TL equal to BA, erect the perpendicular, LR; from the point O drop the perpendicular, ON.

1. Because DP is parallel to AK, and HM is parallel to GT, ETMK is a parallelogram, and TK is its diameter; wherefore the triangle TMK is equal to the triangle TEK; the line TD is equal to the line TE, being a side of the same parallelogram, and DB is equal to EK; the angle at D is a right angle, as is also the angle TEK; wherefore the triangle TDB is equal to the triangle TEK. But the triangle TMK is equal to the triangle TEK; wherefore the triangle TMK is equal to the triangle TDB.

2. The angle BTE is a right angle, wanting the angle DTB, and the angle MKS is a right angle, wanting the angle TKM, which is equal to the angle BTE; wherefore the angle MKS is equal to the angle BTE. The angle at S is a right angle, as is also the angle TBC; the angle KMP is a right angle, the adjacent angle TMK being a right angle. The angle also CET is a right angle; the line KT is equal TB; and the line KS is equal to KT, and therefore equal to BT. The line MK is the opposite side of the parallelogram TMKE, and therefore equal to TE; wherefore the whole figure KMPS is equal to the whole figure BTEC.

3. The angle ABC is two right angles, wanting the right angle CBT and the angle DBT; so also the angle DTB is two right angles, wanting the angle BDT and DBT, and therefore the angle ABC is equal to the angle DBT; the angle DTB is a right angle, wanting the angle DBT; and the angle OTP is a right angle, wanting the angle MTK, which is equal to the angle DBT; wherefore the angle OTP is equal to DTP, as is also the angle ABC; wherefore the angle ABC is equal to the angle OTP. The line TL is equal to the line BA, and the angle TLR is a right angle, as is also the angle BAC; wherefore the whole figure RLT is equal to the whole figure ABC.

4. The line OT is equal to the line TK; the angle OTP is equal to the angle DTB, and therefore equal to ETK; the angle TNO is a right angle, as is also the angle TEK; wherefore the base ON is equal to the base EK, and therefore equal to KH. All the lines of the figure RONL are parallel to all the lines of the figure FKHG; they are therefore equiangular; and the line ON is equal to the line KH, and therefore they are both equilateral and equiangular, and hence equal to each other.

5. The angle ONP is equal to the angle KEF; the angle NOP is a right angle, wanting the angle RON, as is also the angle EKF; the line ON is equal to the line EK, and therefore the whole triangle NOP is equal to the whole triangle EKF.

Therefore the whole square TKSO is equal to the two squares DAET and FGHK.

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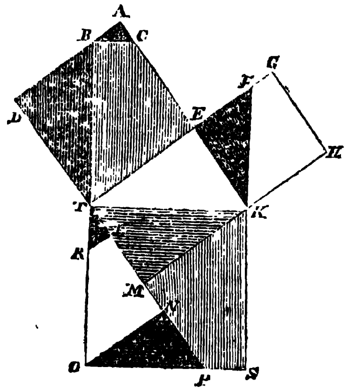

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1. Because DP is parallel to AK, and HM is parallel to GT, ETMK is a parallelogram, and TK is its diameter; wherefore the triangle TMK is equal to the triangle TEK; the line TD is equal to the line TE, being a side of the same parallelogram, and DB is equal to EK; the angle at D is a right angle, as is also the angle TEK; wherefore the triangle TDB is equal to the triangle TEK. But the triangle TMK is equal to the triangle TEK; wherefore the triangle TMK is equal to the triangle TDB.

2. The angle BTE is a right angle, wanting the angle DTB, and the angle MKS is a right angle, wanting the angle TKM, which is equal to the angle BTE; wherefore the angle MKS is equal to the angle BTE. The angle at S is a right angle, as is also the angle TBC; the angle KMP is a right angle, the adjacent angle TMK being a right angle. The angle also CET is a right angle; the line KT is equal TB; and the line KS is equal to KT, and therefore equal to BT. The line MK is the opposite side of the parallelogram TMKE, and therefore equal to TE; wherefore the whole figure KMPS is equal to the whole figure BTEC.

3. The angle ABC is two right angles, wanting the right angle CBT and the angle DBT; so also the angle DTB is two right angles, wanting the angle BDT and DBT, and therefore the angle ABC is equal to the angle DBT; the angle DTB is a right angle, wanting the angle DBT; and the angle OTP is a right angle, wanting the angle MTK, which is equal to the angle DBT; wherefore the angle OTP is equal to DTP, as is also the angle ABC; wherefore the angle ABC is equal to the angle OTP. The line TL is equal to the line BA, and the angle TLR is a right angle, as is also the angle BAC; wherefore the whole figure RLT is equal to the whole figure ABC.

4. The line OT is equal to the line TK; the angle OTP is equal to the angle DTB, and therefore equal to ETK; the angle TNO is a right angle, as is also the angle TEK; wherefore the base ON is equal to the base EK, and therefore equal to KH. All the lines of the figure RONL are parallel to all the lines of the figure FKHG; they are therefore equiangular; and the line ON is equal to the line KH, and therefore they are both equilateral and equiangular, and hence equal to each other.

5. The angle ONP is equal to the angle KEF; the angle NOP is a right angle, wanting the angle RON, as is also the angle EKF; the line ON is equal to the line EK, and therefore the whole triangle NOP is equal to the whole triangle EKF.

Therefore the whole square TKSO is equal to the two squares DAET and FGHK.

INQUIRIES.

NO. 99.

What is the best bronze or lacker to preserve a collection of copper medals from tarnishing, and which will be the best method of applying it? MUSEUM.

NO. 100.

What is the best method for dividing and polishing calcareous and siliceous stones? If performed by a mill, I shall be much obliged for a description. LAPIS.

ANSWERS TO INQUIRIES.

NO. 92.—SPIRITOUS LIQUORS.

Spirits of wine, however empyreumatic or otherwise, may be completely deprived of taste and flavour by adding subcarbonate of potass (salt of tartar) till it falls down dry to the bottom, and the spirit has by this means become of a reddish hue, from its holding a small portion of potass in solution, and from which it may be freed by subsequent distillation in a heat not exceeding 200 F.

The salt of tartar, on being re-obtained by evaporation of the water, is equally efficacious as at first.

As to which substance will give the purest spirit, one will give as pure a spirit as the other. The produce is, from one cwt. of molasses, two gallons to two and a half; from one cwt. of raw sugar, at 46s. 8*d*., about three gallons and a quarter; from refined sugar, at 112s., I am unable to tell, except by guess, but I should suppose it will not yield in proportion to the others, considering the difference of price.

I have very often known one cwt. of molasses produce three gallons; and, when well fermented with four or five pounds of *unmalted* barley or wheat, coarsely ground, it will sometimes produce a greater quantity, viz. three gallons and a half to four gallons.

Raw sugar will not ferment any better with barley, and I am sure I have fixed the utmost it will produce from trial.

The vessel should be a tube similar to a malting-tube, covered with sacks, but not so as to exclude the atmospheric air. The degree of heat should, at the time of putting in the yeast, be about 67 or 68 deg. The time allowed for it to ferment should vary according to circumstances. If the fermentation goes on well, you may commit it to the still in four days; and when you have drawn over the spirit it will produce, and it tastes sweet, ferment it again, and it will yield as much, if not more than the first time. A.B.C.

NO. 96.—CRYSTALLIZATION OF ALUM.

Keep the air from it, and it will not then crystallize.

C.C.C.C.

CORRESPONDENCE.

In making the remarks which we promised in our last, on Mr. Brougham's Pamphlet on the Education of the People, we have been led into a more lengthened review of the subject than we can conveniently afford room for in these pages. They will, therefore, be shortly published in a separate form.

Particular avocations make it impossible for us to acknowledge the favours of our numerous Correspondents this week. We must, however, say to G.A.S., that he has rightly appreciated the cause of our apparent neglect.

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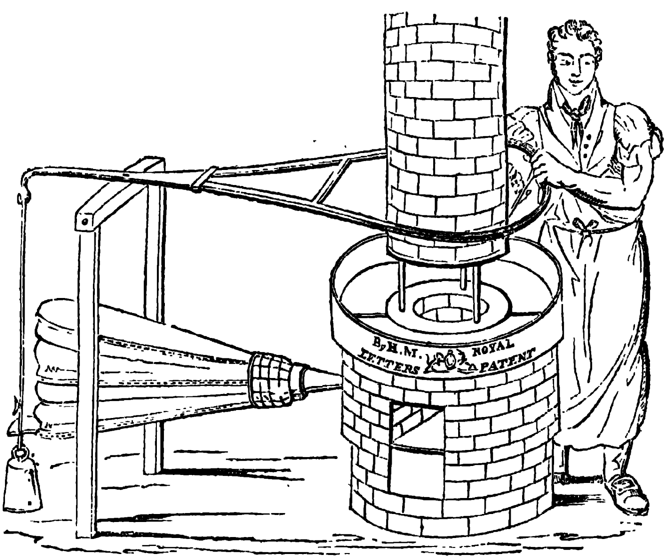
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 79.] SATURDAY, FEBRUARY 26, 1825. [Price 3*d*.

"The more widely Science is diffused, the better will the Author of all things be known, and the less will the people be 'tossed to and fro by the sleight of men, and cunning craftiness whereby they lie in wait to deceive.'"—*Mr. Brougham.*

SPENCER'S PATENT FORGE.



It is presumed that the above Drawing of a Patent Forge, to be used in nail-making and all other manufactories of iron or steel, is so plain as not to require any figures of reference.

Its advantages are, first, a considerable saving in the erection of buildings, and cost of bellows, fuel, &c. &c., as, with this forge, six men can be employed where only four could be by those ordinarily used. The arms of the bellows being circular, they command a steadier and stronger blast, and may be acted upon in front as well as the sides. The circular form of the fireplace, and in which the fire is confined, produces a considerable saving in fuel; and a grating at the bottom of it, by admitting a more free circulation of air, gives a quicker and better heat

to the articles presented for fusion; and, lastly, this form also admits of charcoal being used, whereas, in an open fireplace, this is not practicable.

The combination of sulphur with pit-coal is so injurious to iron, that it is recommended to manufacturers of iron articles to deprive it of this poisonous quality by coking; and in forges of the present description, if a portion of one quarter of charred wood is added to three quarters of charred pit-coal, the articles to be wrought will acquire a considerable degree of ductility and stoutness, and look much finer and clearer on the surface than by any other method.

The patentee of this forge, whose name and house have stood pre-eminent for above a century in the manufacture of horse-shoe nails, finds, by these improvements, that they are much enhanced in quality and appearance.

We understand that licences for the erection of these forges may be obtained, with an ample description, at a moderate expense, from Mr. Joseph Spencer, Belper, near Derby.

CUTTING OF DIAMONDS.

For a long time, at least in Europe, the art of cutting diamonds remained undiscovered, and they were always worn rough as they were found. The diamond is so hard that no means were then known of altering its shape. In 1456 a Dutchman, Louis Bergher, of Bruges, accidentally discovered that by rubbing two diamonds together, a new facet might be given to them. Since then diamonds have been cut and polished, and their beauty much increased. There are two forms into which they are cut, and which are distinguished by the names of rose diamonds and brilliants. By either method, but more particularly by the latter, so much of the gem is cut away that it does not weigh above the half of its weight when rough; and therefore the price of a cut diamond, as to a rough one, in proportion to the weight of each, is always double. The weight of diamonds is estimated in carats, 150 of which are equal to one ounce troy.* The average price of rough diamonds is about 2*l.* per carat, and the difference in their price is, generally speaking, as the squares of their respective weights. According to this scale, a wrought diamond, 3 carats, is worth 72*l.*, and one of 100 carats, 80,000*l.*

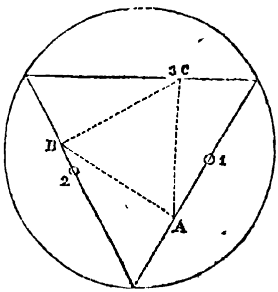
The largest diamond probably ever heard of is one mentioned by Tavernier, who saw it in the possession of the Great Mogul. It was about the size of a hen's egg, and weighed 900 carats in the rough. It was cut in the rose form, and was found in Golconda, about 1550. The largest diamond ever brought to Europe is one now in the possession of the sovereign of Russia. It weighs 195 carats, and was long employed as the eye of a Braminical idol. A French soldier discovered the value of the gem, and changed his religion, worshipping at the altar of the barbarous god, that he might deprive him of his splendid eye. At length he succeeded in substituting a piece of glass for the diamond, and again became a Christian. He had some difficulty in disposing of his plunder, and at length got for it only an inconsiderable sum. It was so large that nobody was able to purchase it. After passing through several hands, the Empress Catherine at length fixed it in the possession of the Russian crown, giving for it the sum of 90,000*l.* and a perpetual annuity of 1000*l.* This is not a handsome gem, comparatively. It is cut in the rose form, and is of the size of a pigeon's egg.

One of the most beautiful diamonds ever seen is the Pitt diamond, which is a brilliant, and weighs rather more than 136 carats. It was brought from India by a gentleman of the name of Pitt, and purchased by the Duke of Orleans, then Regent of France, who placed it in the crown

* It is said, the price of diamonds is so great—the smallest difference in weight making a difference in price—that diamond merchants consult the barometer in their dealings, and like to sell only when the pressure is diminished, and buy when it is increased.

of France, where it still remains. The celebrated Pigot diamond is now in London, in the possession of Messrs. Rundell and Bridges.

CURIOUS PROPERTY OF THE EQUILATERAL TRIANGLE.



If an Equilateral Triangle be inscribed in a circle, and the radius of the circle, taken with a pair of compasses, be applied to the sides of the triangle, beginning in any part (for instance, placing one foot at 1, the other at 2, and so turning the compasses over upon the periphery of the triangle), after a few times, the points will invariably rest in A, B, C.

CLIMAX.

DARKNESS NOT MATTER.

SIR,—It affords me much pleasure to have the opportunity of replying to your Correspondent, Mr. Jacob Morine, as I cannot but think he writes from conscientious motives; for, morally speaking, as human nature admits of no greater perfection than a man's acting from conscientious motives, what is done in this spirit cannot but be well received. It does not follow, however, that concientious opinions are always rationally right, although it is the fact, that however erroneous in this respect they may be, they cannot be wrong morally, as no one will accuse himself or another of moral turpitude, in thinking that is right which is the contrary of what he believes is wrong, however much others may differ from him. Now, I conceive Mr. Morine is not as rationally right as he is persuaded in his own mind of being; and the high authority he appeals to in his letter, No. 76, page 316, is one among numerous instances wherein our own misinterpretations are too frequently substituted for the word of God or the voice of Nature. As we are said, by experimental proof, to ransack Nature for the truth, the literal expression, in other cases, is proclaimed to be the absolute intention of Deity; whereas in both, by misinterpretation, error is substituted (and difference of opinion proves it to be so) for the absolute fact.

I challenge all the learned divines in the world in support of the opinion, that darkness is not of a substantive nature, nor, since the world began, did such an idea as the materiality of darkness ever enter into the head of any philosopher whatever. What, then, can darkness consist in, but a mental affection or state of consciousness. Shadow, of consequence, is the same, and the thing perceived, when we imagine we see external shadow, is, of necessity, no other than a mental effect: hence it is obvious that the expression, "thick darkness, which may be felt," is purely metaphorical language. And with not less reverence for the same authority, we are not obliged to consider, "Let there be light," in other than an equally figurative sense. For, as perception is the *consequence* of sensation, it follows that what is perceived is, in all cases, of a mental nature only; however, from organization and habit, we may be inclined to think otherwise: and as sensation supplies what matter can noways be possessed of, it were as much in vain to have created that which organization creates, as it is absurd to suppose matter to be light or luminous, that is, similar to a state of consciousness. That seeing, is not perceiving any thing outside of us, is evident from the thing seen being what senstation consists in, and from its being colour, which is seen, which is not a quality of matter; in which case a universe of light or luminous matter could afford no assistance whatever towards our discovering

external bodies. Besides, did radiant matter flow from bodies into the eye, it proves only that external bodies are not seen, or this reflection of rays would be useless; and also that what is perceived is a subsequent mental formation, after sense excitement has been promoted: so that neither externally nor internally is there any necessity for the existence of light in a physical sense.

I hope Mr. Morine is now convinced that something more rational and becoming was meant by my paper, page 188, than a mere triumph of words at the expense of all respect for what every one holds sacred.

I shall now add a few comments on the remarks of a Correspondent on the above-mentioned paper of mine, page 188, which I should have replied to at the time but for its being anonymous. That writer insinuates that none but wiseacres differ from Sir Isaac Newton's opinions, and that, in doing so, they aim at "tumbling that great philosopher from an elevation which has been so long accorded to him by universal suffrage." For my own part, I make bold to say there is nothing true in "*The Optics*," from beginning to end, but the mathematical demonstrations of the diagrams, if light be nothing physical, and I defy the possibility of proof that it is: on the contrary, its existence, as such, is denied by all that reason and induction can advance, which afford the *only* species of proof the nature of the subject admits of: and, so far from aiming at undermining the fame of Newton, by differing with him on philosophical topics, if the thing were anyways possible, it would be by that species of timid acquiescence which amounts to the fulsome consideration of his being an immaculate human being, and that science admits of no improvement beyond the state in which he left it. Newton was the greatest philosopher in the world in his day; no individual since could say the same: and with ten thousand times his knowledge, in the coming ages of civilization, can more be ever said of any man? Could his spirit present itself before the Chair he has left, comparatively unfilled until now, how would it smile at mistaken *fellowships* who hold *his* name in *terrorem* over the heads of all who differ from *themselves*. Would it not whisper thus:—"My friends! knowledge grows out of knowledge—do not unwittingly prevent it—I did no more than improve on the past, and with little or no aid from my contemporaries—you, who have immensity of aid, pursue the same course, and always consider our labours improveable."

Yours, &c.
T. H. Pasley.

SHEATHING WITH LEATHER.

The New York Advocate says that, "on examining the state of the leather with which the schooner Eliza was sheathed (see page 317, vol. II.), after a passage to the Mediterranean, it was found covered so thickly with barnacles as to impede the progress of the vessel through the water, and the project, therefore, seems to have been abandoned. The adhesive quality of the leather naturally would invite these marine substances, but it is ascertained that no worm has been able to penetrate the leather; the only protection, therefore, is against the barnacles, and we believe that a coat or two of varnish, or some preparation of that nature, would prevent the barnacles adhering to the leather, and would introduce a valuable improvement: we trust it will not be given up."

PUBLIC BAROMETER.

A Correspondent of the "Manchester Courier" thus introduces to the public an ingenious proposal for "a Public Barometer."

"'Have you seen the barometer to-day?'" is a question *frequently* asked, and to me it indicates an increasing interest in science, characteristic of the progressive improvement of the age—such an inquiry was but *seldom* heard in the days of our boyhood. It is, however, a question connected with a subject that has been hitherto much neglected, although, as every

reflecting mind knows, one of very considerable importance—to the convalescent as to the invalid—to the merchant and the mariner as to the cultivator of the soil.

"It will be enough for my present purpose to assume the utility of the barometer as a means of determining the state of the atmosphere: in order to render it subservient to the purposes of science, frequent and regular observations should be made and registered, and such register should be kept in every principal part of the kingdom. What would tend so much to facilitate such observations, and to accommodate the public, as the erection of a Wheel-Barometer in the most frequented part of the town, and in a situation like that of the public clocks, to be readily seen by every passenger. It will not be necessary here to point out the comparative merits of the different modes of construction of barometers; it is obvious that every useful purpose would be answered by the wheel-barometer on the scale which I propose, provided that the mercurial column be of a sufficient area, and that the connexion between the column and the index be of such a material as is least likely to be affected by atmospherical changes.

"The expense of fitting up such an instrument would be trifling; and as I believe nothing of the kind exists, Manchester may have the opportunity of setting an example which would doubtless be followed by the spirited inhabitants of other towns. I repeat it, the accommodation to the public would be considerable, and the multiplied observations could not fail materially to contribute to the cause of science, the march of mind, and consequently to promote the accommodations of men."

BEET-ROOT SUGAR.

SIR,—As your Correspondent "S. E." in Part 13th of the *Mechanics' Magazine*, expresses his desire for any information respecting the proper "process for obtaining Sugar from Red Beet-Root," I will with pleasure give the few particulars which I received from the man who conducts the *first* manufactory established in France. I regret, however, to add, that, from my imperfect acquaintance with the French language, my account must be received as doubtful, though I believe in the *principal* points it is correct. The beet-root is first well scraped, and when perfectly clean, is placed in a wooden groove, about twelve inches long; at one end of which turns a broad wooden wheel, covered with short iron spikes; and on the opposite end of the groove is closely fitted a plug of wood, which is pushed by hand against the beet-root, the iron-spiked wheel at the same time turning round, and gradually reducing the root to a pulp. A trough placed immediately under receives the pulp, which is then mixed with quicklime, to destroy the acidity. The pulp is next boiled over a slow fire, never exceeding a certain heat. This last process is repeated two or three times, while an attendant skims off the impurities which rise at top. The pulp is, I believe, next separated from the saccharine juice by straining it in wire sieves; it is then put into large stone jars, and left in an airy place to cool. This produces the coarse brown sugar, which is afterwards refined by the usual process.

S. E. has understood, that "fourteen pounds weight of beet-root produced one pound of raw sugar;" but I think my informant told me, that the proportion was "five pounds of raw sugar to one hundred pounds of beet-root."

The process of reducing the root to a pulp seemed to me unnecessarily slow, as there are but two grooves, fitted each with one root at a time. A little simple machinery might easily be made to work twenty or thirty grooves; and the same wheel, or a barrel, somewhat like that of an organ, would just as easily pound the increased number to a pulp, as the present contrivance does only two roots.

Trusting, Sir, that you will be so good as to excuse the errors which I have most probably made in this attempt at description, and that I have

at least shown your Correspondent my wish, if not my ability, to comply with his request,

I remain, Sir,

Your very humble servant,

T. R.

Cornwall, Feb. 3d, 1825.

P.S. The above manufactory is near the Palace of Chantloup, the residence of Count Chaptal, whose permission I obtained to visit it.

RAILWAYS.

Sir,—I am very sorry to say that I find myself quite as great a "novice" as G. W., page 269, and so much a "thorough-paced practical man," that I never can admit, upon any terms short of complete demonstration, that the same power which is expended in producing an effect equal to 1 will, without alteration or increase, produce an effect equal to 20, much less that it will produce an unlimited effect.

In page 239 of your Magazine is the following passage:—"Secondly, setting aside the resistance of the air, the very same amount of constant force which impels a car on a railway at two miles an hour would impel it at ten or twenty miles an hour, if an extra force were employed at first to overcome the inertia of the car and generate the required velocity." This I deny, and on the following grounds:—

A little before, on the same page, is the following passage:—"First, it follows, from this law, that (abstracting the resistance of the air) if a car were set in motion on a level railway, with a *constant* force *greater* in any degree than is required to overcome its friction, the car would proceed with a motion continually accelerated, like a falling body acted upon by the force of gravitation."—This I admit; it is conformable to the experiment of Mr. Professor Vince. I am likewise aware that, when a weight is *uniformly* raised by a machine, the pressure on that machine is equal to the weight, let it rise at what velocity it will; but it is obvious the faster the weight rises the faster the machine must move to continue to balance the weight.

Suppose, then, as in page 245, that the friction of the car is just equal to 90 pounds hung over a pulley at the end of the plane on which the car is to move, the moving force and the resistance are in equilibrium, and the car remains at rest; but, if 10 pounds be added to the 90 pounds, we have a moving force equal to 100 pounds, and a resistance equal to 90 pounds; our weight will now begin to move our car, and in the first second it will move through 10 3-19 inches (see Gregory's Mechanics); but, for the sake of round numbers, we will suppose a heavy body, by the force of gravity, to descend through 190 inches in the first second, in which case our weight will descend through 10 inches in that time; in the next second our weight descends 30 inches; in the third 50 inches, and so on; the spaces increasing in exactly the same ratio as if the weight fell freely. Now we know the weight, if left to itself, would have descended through 190 inches in the first second, but it has only descended through 10 inches; a force has, therefore, acted on it sufficient to make it describe 180 inches in a second, with a uniformly accelerated motion; for it has counteracted so much of its weight (see Ency. Brit. art. Machinery). Our expenditure of force in the first second will, therefore, be represented by $180 \times 100 = 18000$. Pursuing our calculations by the same rule, our expenditure of force in the first *two* seconds will be represented by 100 pounds, moved through 720 inches, $= 72000$. Deducting the force employed in the first second, we have 54000 to represent the force we have expended in the second second of time. Proceeding in the same way, we find, in the first *three* seconds, we have expended a force $= 100$ pounds moved through 1620 inches $= 162000$; deducting the sum of the forces expended in the two first seconds, we have 90000 to represent our expenditure of force during the third second *only*: we see, therefore, that the force expended upon the friction of our car, for we have

as yet considered nothing but the friction, increases in the same ratio as the velocity increases, that is, considering our velocity as 1 in the first second, our force may likewise be represented by 1; in the next second our velocity is 3, and so is our force expended during that second. Indeed, the great Smeaton, as long ago as April, 1776, demonstrated to the Royal Society, that "the mechanic power, which must of necessity be employed in giving different degrees of velocity to the same body, must be as the square of that velocity."

Let us view this matter in another light. Our car, then, the friction of which is equal to 90 pounds, hung over a pulley, is standing still on our railway; we now apply a moving force by means of machinery equal to 100 pounds, and we suppose this force capable of moving at any velocity. We may compare the amount of this force in equal times, by merely multiplying it by the space passed through: in the first second it moves our car from a state of rest through ten inches; at the end of this time it is moving with a velocity which, without any new impulse, would carry it through twenty inches in the next second. Our force must now move at the rate of twenty inches in this second merely to keep up with the car; but as we suppose our force an accelerating one, it will not only *keep up* with the car, but will continue to *press* upon it as strongly as it did during the first second: this will cause it to describe thirty inches in the second second of time; and by the same rule, our power still acting on the resistance will cause the car to move through fifty inches in the third second; and our expenditure of force may be comparatively represented as follows:—For the first second it is 100 pounds moved through ten inches = 1000 pounds moved through one inch; for the next second it is 100 × 30 = 3000; and for the third, it is 100 × 50 = 5000 pounds moved through one inch.

Now, let us see, according to this calculation, what comparative power, according to the velocity, the steam-coach, mentioned in page 217, will require. We will take the resistance of the air according to the estimate there given, and suppose it equal to two and a quarter pounds, at four miles an hour; this, with 100 pounds for friction, as is there allowed, will be represented by

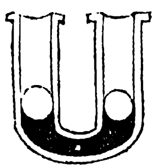
102 lbs. moved through	4 miles	= 408 lbs. moved through one mile in one hour.
105	6	= 630
109	8	= 872
120	12	= 1440
137	16	= 2192
158	20	= 3160

Of which last number 2000 pounds have been expended on *balancing the friction alone*; and yet the writer of the article alluded to has the hardihood to assert, "that, speaking practically, it would cost no more to command a velocity of twenty miles an hour on a railway, than a velocity of one;" and, in page 239, he "thinks it right to say, that the conclusions he has announced are strictly conformable to experiments made by Vince and Coulomb!" Now, Sir, is it fair to call a man "wrong-headed" and "dogmatical" for denying absurdities like this? But the writer indulges in expressions, in page 245, which, to say the least of them, are uncourteous and uncalled for. For my part, I am essentially a practical man, and am proud, very proud, of belonging to so useful a portion of society—to a portion which could claim among its members a Smeaton and a Watt, who were entirely practical men, and who have done as much for their country as any of the theoretical mechanicians it has ever produced. At the same time, I must take this opportunity of expressing the profound respect I entertain for the good theoretical student; I look upon him as a fellow-labourer in the same cause to which my own labours

are devoted, but in a much higher department. Were I asked to describe such a man, I should say, he was a philosopher whose philanthropy incited, and the power of whose mind enabled, him to discover the laws which govern the most abstruse operations of Nature, and apply them to the improvement of the arts of life; I should say, he was one who was studiously careful never to offer the practical man a rule of the truth of which he was in the least doubtful, or which truth he was unable to demonstrate; and I should add that I was at all times his most sincere admirer.

S. Y. (a young Engineer.)

A DOUBLE-BARREL MORTAR.



Sir,—Having noticed, in the discharge of pieces of artillery, how much power is lost in producing recoil, which indicates similar loss, although there may be no recoil, I send you the plan of a Mortar, the principle of which is, to obtain all the propelling power possible from a given quantity of powder. The figure prefixed shows, at one view, a longitudinal section of the machine, consisting of two calibres, a shell in each, the reduced space between for a sausage-cartridge, with the touch-hole in the neck which connects the two cylinders. The charge being double that of a single mortar, there seems no reason for imagining any explosive power would be lost; but, on the other hand, if what produces the recoil, in ordinary cases of single barrels, in this be efficient on the opposite shot, the impulse will be greater on each shot from an equal charge. The operation of forcing the cartridge in will clean the neck of the mortar; time, and perhaps ammunition, may be gained, and the execution not only doubled, at least, but when two shot or shells strike the same object at the same time, the effect will be greater than from ten striking the same, with intervals of time between.

I am, Sir,
Your obedient servant,
C. D. Y.

THE OPTICAL QUESTION.

Sir,—Your Correspondent, "A Much-amused and Constant Reader," at page 315, No. 76, vol. iii. says—"An object 5 feet in height, &c. would be reduced to the thirty-second part of one-eighth of an inch, or rather 1-5280th part of 5 feet."

This assertion is not correct: the same object would be reduced to 1-264th part of an inch, or 1-15840th part of 5 feet. The two rays would form the two sides of an isosceles triangle, the perpendicular of which is 3 miles, and the base 5 feet. If we take a point in the perpendicular one foot from the vertex of the triangle, through which point, if we we draw a line parallel to the base, this line will be 1-264th part of an inch in length. By similar triangles we have this proportion:—As 3 miles, or 15840 feet : 5 :: 1 : $\frac{5}{15840}$ of a foot, or $\frac{60}{15840}$ of an inch; which, reduced, is one $\frac{1}{264}$th part of an inch.

We do not here imagine that your Correspondent is ignorant of what has been stated. Most of your scientific readers wish to see, without doubt, on what grounds such calculations are made.

I am, Sir, yours, &c.
Joseph Hall.

Harpurhey, Feb. 12th, 1825.

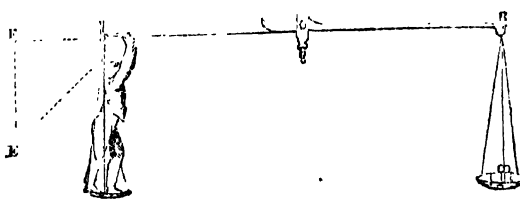
BUCHANAN'S CAPILLARY STEAM ENGINE.

We inserted in a former Number (page 50, vol. iii.) the Report of the progress of a Capillary Steam Engine, invented by a Dr. Buchanan, of America. The following notice of one

practical application of it we extract from a Louisville (Kentucky) Paper, of the 21st December :—

"We are gratified to hear that Dr. Buchanan has succeeded in propelling a boat by the application of his newly-invented generator. On Sunday last she ran five or six miles up the river, and returned with a number of gentlemen, who seemed much pleased with its operation. The advantages which it is considered to possess over boilers now in use, are economy in the cost, a considerable saving of fuel, lightness, the space which it occupies, and entire safety against accidents resulting from the bursting of the boiler; advantages which, combined, cannot fail to introduce it into general use. The boiler weighs about five hundred pounds. We understand the Dr. intends applying it to propelling carriages on land, in which he feels confident it will be eminently successful."

THE BALANCE QUESTION.



SIR,—I am induced to write to your useful and widely spread publication, in order to set at rest the Balance Question, as stated at page 224. Neither of the explanations given by G. B. or the Young Engineer, appear to me to convey any sort of proof, or assign any cause, for the singular property mentioned by C. D. The explanation proposed by Mr. C. Eagland is right in principle, and the tone and manner he has adopted is the best way, in my opinion, to call forth the explanations or opinions of others. I will endeavour, as far as my humble abilities will allow me, to prove the property in question.

Description.

Let AB represent the beam, H and D the scales, and suppose a person in the scale, H, was kept in equilibrio by a weight in the scale, D; now, if the person in the scale, H, pushes upwards at the point, G, between the fulcrum, C, and extremity of the arm, A, he will protrude the scale in an oblique direction, as, suppose, GE; then draw EF parallel to HA, and produce CA to F; then the effect produced by the scale will be the same as if it was hung perpendicular from F, and the preponderancy of the man's weight is increased in proportion of CE to CA.

Now, again, to prove the assertion, when the scale is prevented from being thrust out of a perpendicular position. Let HG represent the force exerted by the man against G; then, by the resolution of forces, it will be resolved into the two, HA, AG; but AG is in the direction of the beam, therefore it can have no effect in turning it about its centre; hence AH is the direct force, and HG : AH : : radius : sine of the angle HGA, or the oblique force is to the direct force as radius is to the sine of the angle HGA.

The foregoing is drawn up in rather a hasty manner; but if it should be not quite intelligible to any of your readers, I will endeavour in any future Number to be more explicit, as far as my time will allow me.

I remain, Sir,

Yours respectfully,

GEORGE GREGORY.

4, Philip-street, Kingsland-road.

SIR,—On reading Number 70 of the *Mechanics' Magazine*, I thought

that C. D.'s observation on "the Property of the Balance" was not perfectly correct, and that the effect produced must depend on what part of the beam the operator's hand is applied to. Upon making the experiment, I find, first, that if a person placed in the scale, A, and balanced by weights in the other scale, apply a repulsive force anywhere to that part of the beam denominated B, that the scale preponderates in which the operator stands, as stated by C. D.; but, secondly, if the force be applied to any part of C, that it will have a contrary effect; and, thirdly, that if the force be applied exactly on that spot from which the scale, A, is suspended (or the scale D, if the two scales are at an equal distance from the fulcrum), no effect will be produced.

I am, Sir,
Yours respectfully,
J. B.

STEAM NAVIGATION.

SIR,—In my letter, page 164, vol. III. there is a numerical error; the fourth term of the analogy, stated to be 2.94, should be 5.88. By proceeding with this, as directed, we have $\sqrt{5.88}+6=2.425+6=8.425=$ miles = the vessel's velocity from the effect of the wind and steam acting together. The following general theorem is deduced from the reasoning in my above-mentioned letter :—

$$\sqrt{\frac{V \times \overline{W-V}^2}{F}}+V=\sqrt{\frac{6 \times \overline{20-6}^2}{200}}+6=\sqrt{\frac{1176}{200}}+=$$

$$\sqrt{5.88}+6=2.125+6=8.125,\ \textit{Ans.}$$

in which V = the vessel's velocity by steam, F = a number proportional to the force which generates the said velocity, and W = the wind's velocity. In the above, F is = W^2; but this can only happen when the wind and steam act with equal fotce; but, as the steam does not always act with the same power, F is a variable quantity. However, as the pressure of steam is or may be indicated by a barometrical tube, I hope, with the aid of experiments, to pursue this interesting subject, and will, in a future letter, explain the method by which I propose to find the value of F when the steam acts with a different force from the wind. In the meantime I shall feel much obliged, Mr. Editor, if yourself or any Correspondent will inform me what instruments have been invented to measure the velocity of the wind, and where they may be purchased, or information obtained respecting them. I beg to observe how nearly D. Screw's answer and mine *in this case* agree, (vide his letter, page 290, vol. III.) His answer is 8.4852 miles, and mine is 8.425; but his theorem cannot hold good when much steam is used in a light wind : for instance, if the boat were impelled by steam alone 8.8 knots, and a breeze spring up, moving at the rate of 8.7 knots, D. Screw's theorem would give *some* increase of velocity to the boat from the effect of this breeze, which would be manifestly impossible, for, in such a case, the steam moves the boat faster than the wind that follows her. I certainly do not know how much or how little velocity D. Screw would ascribe to the boat from the action of a breeze moving 8.7 knots; but it is clear that some would be produced if such a breeze acted alone on the vessel; therefore D. S.'s theorem would show some increase, which being impossible, the theorem cannot be *generally* right. My theorem, in such a case, would give a *less* velocity than 8.8; for that part of it which represents the velocity of the boat produced by the wind acting with the steam (in this case), would be *a negative quantity*, and which would actually be the case in *practice*; for, were a commander of a steam-boat to set his sails when the steam impelled the boat faster than the wind followed her, he would have a back-sail, and produce a retarding and not an accelerating force:

this, however, he would be well enough aware of without trying the experiment.

I remain, Sir,
Your very obedient servant,
PADDLEWHEEL WIND-AND-STEAM.

P.S.—I give the above theorem but as a near approximation to the the truth; for, when $\overline{W - V^2}$ is a *positive* quantity, a deduction must be made.

LONDON IMPROVEMENTS.

SIR,—As a constant reader of your valuable work, the *Mechanics' Magazine*, I perceive several remarks and observations on the Improvements of London; some executed, some in contemplation—one liking one thing, and one another. Now, Sir, you will very much oblige me by allowing me space to say what I should like; and if the whole or any part of it can be executed, I shall feel myself in duty bound ever to pray, &c. &c.

I take it to be very clear, that should the population continue to increase in this great metropolis for a few years longer, the business in it cannot be carried on but at a very great risk of life, and inconvenience to his Majesty's subjects, unless many important alterations are made in our public thoroughfares. Ought we not, therefore, to embrace the opportunity for improvement which now offers, when our trade, commerce, and manufactures, are flourishing in all parts, and money at so low an interest?

I should like, however, in the first place, that all public works, or works for public benefit, should be made known to the public before the plans are acted on, as by so doing some fool or other, unknown to the wise men at the head of those concerns, might possibly improve upon them; and if he did so, he should be properly rewarded. I must, moreover, say, that if improvements are to be made, they should be such as may be useful and beneficial for ages to come.

I like the intention of removing Fleet-market, and, as it is said, opening a way to the north of London; I also like the suggestion of opening a road to Tottenham-court-road. Nor do I dislike opening a way from Coventry-street to Holborn, as suggested by one of your Correspondents; but, above all, I should like a nearer way from Coventry-street into the City, and a commodious way too, so that the courtiers may drive from the west to east, and calculate on the time they have to return, which now they cannot do, on account of the many obstructions they are liable to in the Strand, Fleet-street, and Ludgate-hill. To do the thing as I should like, it must, I suppose, be a Government concern, beginning in Coventry-street, and ending at Temple-bar, or, still better, at Cheapside. The line I shall point out between Coventry-street and Temple-bar, touches that description of property in general which would be much improved by such an undertaking. The loss of that portion given up to the public would, in a very few years, be regained by the advanced rents such a line of street would yield to the proprietors; while a great portion would immediately advance in value from 20 to 50 per cent., without putting the owners to any other than the expense of a more elegant front; other portions of it would pay from 50 to 100 per cent. in advance, taking into the account the increased value of the ground for building. I shall begin by setting back the whole line of houses on the south side of Coventry-street, Haymarket, about twelve feet, more or less; then make way into Leicester-square, passing along the north side to Bear-street; widen the south side, and more so the east end; proceed on to St. Martin's-lane, and thence cross Bedfordbury to Henrietta-street, Covent-garden. I should like much to set back the whole of the south side of this latter street, as far as the south-east corner of the market, for the purpose of more market-room. I would then make my way to York-street, cross Brydges-street (I believe I could pass on without upsetting the News press-office), and dash through White Hart-yard to Wych-street, which I would widen by taking down the whole line of houses on the south side, and farther improve by rebuilding the whole of the north side. I leave you here, unless you are disposed to make a thorough good job of it; and if so, we will begin again, commencing at Essex-street. Let all the houses from thence to Temple-bar be put back in a line with the houses on the west side of Essex-street. When you are at Temple-bar, clear that all away, or so alter it as to widen both the carriage and foot ways. (There may be a gate constructed, if there must be one, somewhat on a drop plan.) I want next, from this spot, a view of that noble structure and national ornament, St. Paul's Cathedral; but to do this I must have the skirts off the lawyers' coat, by touching on the avenues of the Temple. I will not, however, attempt to touch the Temple itself, as there are so many queer upper stories there, but go to St. Bride's Church in a straight line, setting back the whole of the houses on the south side of Fleet-street. Beyond St. Bride's, I would also set back all the houses in a straight line up to St. Paul's Church-yard, in a line with the houses on the south side of the Church-yard. From thence we go to the north side of

Fleet-street, commencing at St. Dunstan's Church; and as a loss of property given up to the public on the sorth side, regain a valuable part, by bringing the line of houses forward into the present public road. Go on in this way, as occasion may require, until you come near St. Paul's Church-yard; then down with and rebuild, some yards farther back, a few houses at the top of Ludgate-hill, on the north side; set back also, or clear away, all the houses on the north side of St. Paul's Church-yard to Paternoster-row. Do then as you like here, not forgetting to make a way through to the new Post Office, leaving a good opening to St. Paul's, for I do not like to have this noble pile of building so hemmed in.

Now, Mr. Editor, if you will not allow me all this, begin at least in Fleet-street, after leaving Temple-bar complete, and at Salisbury-court end, commence widening onwards to St. Paul's.

I think I have here pointed out the best line of way from the west to the east into the heart of the City; but there is another way of accomplishing the same object, which is worth mentioning. It would not, indeed, be so palatable to the people of Fleet-street and Ludgate-hill; I should be upset too by the wigsmen, and, in my way, stand a chance of getting into Newgate; but if I could pass the former, the latter I should not so much mind, as I seem disposed to pass over Fleet-market on a triumphal archway, and take a flying leap to St. Paul's, and possibly knock down in that flight the spire of Ludgate.

Either of these improvements would be worthy of this wealthy nation, add to the convenience of its trade and commerce, lessen its expense by a quicker dispatch of business, save many a life from an untimely end, give an elegance to the town, and unfold one or more of its greatest ornaments.

The Legislators can find ways and means for any thing they wish; I should think they might look into some corner of unclaimed dividends, or otherwise, to accomplish something like this.

The new street called Regent-street, and this projected street, would make a comical sort of crooked T, which, as the first letter of my name, I subscribe.

T.

AMERICAN CUTLERY.

The Newbury Port Herald says—"We have seen some specimens of uncommonly nice and ingenious workmanship and mechanical skill, made by Mr. Nathaniel Perkins, of this town. They consist of a pair of scissors, complete in all their parts, and of perfect construction and finish, precisely *one inch* in length; and, what is more curious still, another pair of scissors, equally complete and of equal finish with the first, but only *three-tenths* of an inch in length. These last have a steel tag and an ivory bodkin of the same length with them, to match. The whole set being, when shown to us, contained in a needle-book of appropriate dimensions, formed one of the most beautiful collection of miniature workmanship imaginable. We recollect seeing a card of Rogers, the Sheffield manufacturer, whose penknives and other fine cutlery are so celebrated, in which mention is made of a pair of scissors of his manufacture, weighing only half a grain, as a *great* curiosity. The scissors made by Mr. Perkins are a still *greater* curiosity, as they weigh less than half a grain. Mr. Perkins appears to have a large share of the mechanical talent of his family, and is highly deserving of encouragement."

PRESERVATION OF MARBLE.

A wash for the Preservation of Marble has been recently invented by Messrs. Garnier and Co. of Paris, which is already very generally adopted in that capital. It secures purity and solidity of the marble from the attacks of moisture and of saltpetre, and is calculated to become a cheap and useful substitute for paper-hangings and paint, being as well suited for the interior. It is as white as marble, and also capable of receiving fresco paintings. The ancients are said to have used something of this description, as many of the buildings in Pompeii were found covered with a thin white coat; and if such an invention was necessary in such a climate as that of Italy, it is doubly so in such a latitude as Paris.

PERPETUAL MOTION.

Sir,—Reading in your Mechanics' Magazine an account headed, "Another Perpetual Motion Imposture," I beg to inform you that a Scotsman, much marked with the small-pox,

and whose name, according to his handbills, was Adams, about two years since, exhibited, for eight or nine days, his pretended perpetual motion at this place, and, I believe, took the natives in for fifty or sixty pounds. Accident, however, led to a discovery of the imposture. A gentleman, viewing the machine, took hold of the wheel or trundle, and lifted it up a little, which I suppose disengaged the wheels that connected the hidden machinery in the plinth, and immediately he heard a sound similar to that of a watch when the spring is running down; the Scotsman was in great anger, and directly put the wheel into its proper position, and the machine again went round as before. The circumstance was mentioned to an intelligent person, who determined to find out and expose the imposture, and took with him a friend to view the machine; they seated themselves one on each side the table upon which the machine was placed; they then took hold of the wheel and trundle, lifted them up a little; there being some play or liberty in the pivots, directly the hidden spring began to run down. They continued to hold the machine in spite of the endeavours of the Scotsman to prevent them. When the spring had run down, they placed the machine again on the table, and offered the Scotsman fifty pounds if it could then set itself going. Alas! notwithstanding his fingering and pushing, it remained motionless. A constable was sent for, the impostor went before a magistrate, and there signed a paper confessing his perpetual motion to be a cheat. He was suffered to go at large upon promising to leave the town. I am confident, from the description, that he is the same person alluded to by your Correspondent.

To prevent others from being deluded and cheated by this impostor, is my motive for making this communication.

I am, Sir,
Your obedient servant,
A WELL-WISHER.

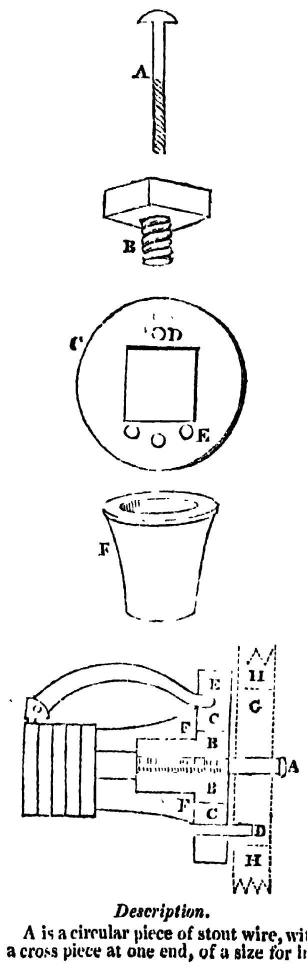
Stroudwater.

COMBINATION LOCK SECURITY.

SIR,—Agreeable to your wishes, I send you a sketch and description of a Horizontal Combination Lock Security, for door and other locks, of my invention.

I am, Sir, &c.
Your obedient servant,
G. M. H——N,
Lieutenant, Royal Navy.

Exeter, Aug. 31, 1824.



Description.

A is a circular piece of stout wire, with a cross piece at one end, of a size for in-

troducing into a keyhole, and formed as a screw at the other. B is a circular piece of iron or brass, having at one end a square shoulder, of about two-thirds of an inch square, and about a third or half an inch thickness; on the circular part, a screw is to be made, of five or six threads, close up to the shoulder. In the centre of this piece, B, form a corresponding thread to the screw A, quite through. C is a circular plate, iron or brass, of the same thickness as the shoulder of B; in the centre of C a square is cut through, to fit easily over the shoulder, B. D is a small piece of iron, half an inch projection, fixed in, and just beneath the centre of one of the squares of the aperture in C. On the opposite side make three holes, quite through, on a parallel with the circle of C, about the size of a crow quill; call these holes E. F is a conical piece of iron or brass, of about two-thirds of an inch long, flat at the ends, about an inch diameter at its base, and its small end agreeable to the size of the diameter of the combination lock, to be applied to this end. At the base and centre of piece F, form a corresponding screw to the screw of B, sufficiently deep to make the shoulder or base of F come close against the shoulder B. At the small end of F, and centrical, form a screw orifice, corresponding to the screw end of any combination lock you mean to use for the purpose. The common combination locks now in general use will apply to this purpose, by taking away the end-piece from the screw, and having a bar-bolt made longer, as I shall hereafter mention. The mode in which this horizontal combination lock security will apply, is thus :—

Proceed with ABCD, as specified in my Lock Security, inserted in your Number 46; the base end of this conical piece, F, in the present sketch, is then to be screwed on to B, tight against the piece C. Having fixed your letters or figures of your combination lock to your fancy, screw into your small end of piece F the screw of your combination lock; and so contrive this screw, when screwed tight in its place, to bring the bar-bolt uppermost, and in a line with one of the holes, E; and let this bar-bolt be of such a length, when the combination lock is drawn out for unlocking, that the end of this bolt shall lift up clear, and disengage itself from the hole, E, and the circular plate, C.

In unlocking this security, there will never be any necessity for unscrewing your combination lock from your piece, F, unless for the purpose of altering your combination letters or figures, on suspecting your combination to be known; you need only to unscrew F from B, when the bolt is withdrawn. The machinery is taken off or applied in three pieces only, when once fitted to the door or chest you may have occasion for its use. I have not represented the combination lock as a section, but as applied, with four combination rings, to the section of my machinery, in the position of locked, with the piece, A, transversed, as in a keyhole. The dotted lines, G, represent the key-hole, and H as part of the lock.

INQUIRY.

NO. 101.—REFRACTING TELESCOPES.

Sir,—I have lately purchased a refracting telescope of considerable power; it shows most distinctly the ring and some of the satellites, belts and satellites of Jupiter, &c.; but my astonishment is great in turning the tube to the planet Venus, whose figure is scarcely distinguished, being involved in prismatic colours.

Will any of your Correspondents point out the explanation, and if the failure is to be attributed to a defect in the instrument?

I am, Sir, yours, &c.

Theodore.

ANSWER TO INQUIRY.

STEAM PIPE JOINTS. (P. 111, VOL. 3.)

Sir,—In reply to the inquiry of your Correspondent I. T., from Henley-on-Thames, respecting Steam Pipe Joints, I have to inform him, that I have found Messrs. Parker and Wyatts' Roman cement an excellent one for the end-joints of iron pipes for water, as the following account will fully show:—In December, 1804, I bought the house which I then, and for many years before, had lived in, with the extensive premises attached to them, at Bridport Harbour, in Dorsetshire. At first I obtained my supply of fresh water from a well about 20 feet, the water from which was pumped up into a reservoir, that would contain from 16 to 20 hogsheads. From the bottom of this reservoir it was conveyed to my house and a neighbouring one, distant about 900 feet, through wood pipes, the greater part of which were laid in loose sand, but a little way below the surface. From this last, or some other cause, there was a frequent leaking in the pipes, which occasioned a good deal of inconvenience and expense in taking up and repairing, and made me anxious to get something that would answer better. I had seen, near Neath, in Wales, that

Iron pipes were used in raising water from some of the coal-mines; I therefore determined on trying iron instead of wood, and made application to Mr. J. Price, the manager of the Neath Abbey Iron Works, for what I wanted, and, by his recommendation, I got from those works the quantity of iron pipes I needed, of three-inch bore. I ordered at the same time for two ladies, my intimate friends and neighbours, who were supplied at their house with water from a spring at a distance, conveyed through wood pipes, and who had been subject to the same inconvenience that I had long felt, three or four hundred feet more. My order for both was for part spigot and faucet, and part flanch pipes; but were I to do any thing of the sort again, I should have all flanch pipes, as they are much more easily taken up or shifted. Mr. Price's directions were, first, to mix a quantity of white lead with linseed oil to the consistence of thin paste, and to lay a coating of this with a paint-brush on the inside of the faucet end, and the outside of the spigot end. Some narrow slips of canvas, covered on both sides with the same substance, were then ordered to be carefully put round in the spigot end of the pipe (in the same way as is done with brown paper to tap a cask), and the spigot end carefully screwed into the faucet end. In order to drive them together as tight as possible, he farther directed, that a piece of wood, sharpest at one end, of about six feet long, should be stuck into the ground, so that a man could get a good purchase on the end of the pipe opposite, into which the man with a sledge was to drive the piece of wood, which the person using it was to keep as tight to the iron as possible, as the pipe itself, if struck, is liable to break. With respect to the flanches, Mr. Price directed that a sort of round hemp gasket should be made, of a diameter larger than the bore of the pipes, and that it should be well covered on all sides with white lead and oil. The flanch ends were to have a coating of the same white lead. The gasket was then put between the two flanches, and held in its place by a boy with a piece of twine, to which the gasket had been previously suspended, till the flanches had been brought together and thoroughly secured by four screws and nuts. Mr. Price was so obliging as to send me a spigot and faucet pipe, and two flanch pipes, put together for patterns. After receiving the whole, I was much at a loss what class of workmen to employ in laying the pipes, as nothing of the sort had ever then been seen or heard of, to my knowledge, in that part of the country. On consideration, I fixed on a common country carpenter, of the name of George Swaffield, of the little village of Bothenhampton, and a working stone-mason, of the same description (Thomas Everett), of the little village of Shipton Gorge, both near at hand, and ordered them to come with their men to do the work. I fixed on them, as I had often employed them to do things they had never seen or done before, and I had always found they carefully followed my directions. They began the work, as well as I can recollect, in the early part of December, 1805, and laid down about ten or a dozen pipes, chiefly under my constant inspection. I then had the lower end of the last pipe plugged, and let in the water, and I was much pleased to find all quite tight. I then directed them to lay down twenty or thirty pipes in the same way, very carefully, but I was very little with them myself while they were about the job. On again plugging the lower pipe, and filling all with water, I was disappointed to find that the pipes leaked in many places. I blamed the two master-workmen I had employed with having been negligent, and inattentive to the orders I had given them; but they both assured me that such had not been the case. I then directed that the pipes should be taken up again, and meant to have filled each pipe with water, as soon as well fixed, to prove it. As this, however, would have been very troublesome, and would have taken up much time, the mason, Everett, said he was sure he could stop all the leaks with Roman cement, as he had used it frequently against hot and cold water, and found it to set and harden well in both. He referred particularly to a piece of work of this kind, which he had executed for an intimate friend of mine, who lived about two miles from me, and who, he was sure, had still some of the cement by him. I had never at that time heard of the article, but sent Everett to my friend to state my difficulty, and to borrow what he needed. This he kindly supplied him with. I now made the men scrape off carefully all the white lead, as Everett said the cement would not adhere to paint. A luting of the cement was then carefully put round every end-joint; and as there were here and there a few small holes and defective places in some of the pipes, a luting was put round those also. In about two hours after the pipes had been all thus repaired, they were again filled with water, and I had the pleasure to find them all quite tight. The whole line was then carefully laid down in the manner before-mentioned, and a luting of the cement put on over every end-joint and visible defect. The end of the lower pipe was then plugged, and the whole line filled with water, and all was found quite tight. The work was finished on Christmas Eve, 1805.

Finding in the lead pipes in the house some little leaks, Swaffield, the carpenter, carefully hammered the edges of the

places where the leaks were together, and put a luting of the cement round the lead pipe, to which it adhered firmly. The leaks were now quite stopped, and from that time till the present hour the work has not cost one penny in repairs. The water rises from the iron pipes about eight feet in the house.

A few years since, a partner in the house of Messrs. Parker and Wyatt having called on me, I directed the ground to be opened, to show him a few lengths of the pipe, and on examining the cement luting, we found it apparently as hard as stone. Some years after, I opened the ground a few lengths to show a friend, who was about a similar work, and the pipes and lutings were found in the same state as before.

On a first trial to use the water, it was found of the colour of rusty iron, and had a metallic taste. As I had somewhere read or heard that lime would purify water, I ordered a bushel of unslaked chalk-lime to be thrown into the reservoir when full of water; and when it was quite slaked, that the mixture should be well stirred together. The pipes were then filled with it, and after remaining some time, the water was run off. For a few days, or a week after, the water had a milky appearance and the taste of lime; but these peculiarities soon went off, the water became pure and excellent, and it has been since constantly used at table, for tea, for washing, brewing both strong and table beer, and every other domestic purpose; for all which it has been found to answer well, although the well is not two hundred yards from the sea at high water. The soil is what is called a yellow fox mould earth, on a bottom of lime-stone mixed with the same sort of earth, and the top of the well is not twenty feet from the level of high water spring tides.

In the spring of the year 1806, I superintended the laying down of the pipes for the two before-mentioned ladies; the same persons were employed, and the pipes answered as well as mine. Shortly after, a professional friend, who wished to have water conveyed to the houses of two of his clients, one from a distance of upwards of two thousand feet, and the other between one and two thousand feet, procured at my recommendation the requisite pipes from the same place, and employed the mason, Everett, to do the work, which has also answered well. I was afterwards applied to by the steward of a nobleman, resident about eighteen miles from my then house, for information on the subject. This person had got ready for his Lordship about five thousand feet of pipe on the spot where it was to be used, and at his request I engaged the carpenter, Swaffield, to go and do the work, which he accomplished most satisfactorily. It has continued ever since to answer well.

It must be for the consideration of your Correspondent from Henley-on-Thames, whether the same substance may be effectual against the power of steam on the end-joints of iron pipes. Possibly, if a thin hide, well soaked in water, could be passed twice round the lutings very carefully, without shaking or cracking the cement, and then secured on each end of the hide by several turns of a small cord tightly fastened, it might prove an additional security.

I have gone more fully into the matter than I otherwise should have done, in the hope that, from the very extensive circulation of the *Mechanics' Magazine*, it might afford some useful hint to some of its numerous readers. Should it prove so to any of that useful class in particular, for whose advantage it is chiefly intended, it would give me great pleasure.

I am, Sir,
Your obedient humble servant,
H. B. WAY.

5, Montpelier, Bath, Nov. 20, 1824.

N. B. Since writing the above, it has occurred to me that, about the year 1806, I wrote to Messrs. Parker and Wyatts, that I had used their cement in the way before-mentioned, and that I gave them the information with a view to their making any use they might think to their advantage. It is, therefore, not unlikely that their cement may now be generally used for such purposes, though I am not aware of having seen it, except in the foregoing instances.

CORRESPONDENCE.

Dr. John's Paper in our next.

We are obliged to "Snug" for favouring us with his address.

We shall be glad to receive the communication offered by J. S.

The "Rule Manufacturers of Birmingham" shall have an answer in our next.

Communications received from—Mr. Dickenson—Mr. Andrews—T. Rekrap—M. Monnom—D. Y.—T. M. B.—Cæsar Borgia—Isaac—Aurum—T. Parker—R. H.—F. H.—S. R. S.—A True Well-wisher—A Ship-owner—S.P.—J.G.—Artenovus—E. Jenneson—R. D. R.—R. D. —W. W.—A Plumber—R. K.—J. N.—J. E.—Mr. Gouger—A Constant Reader —J. W.—B.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.
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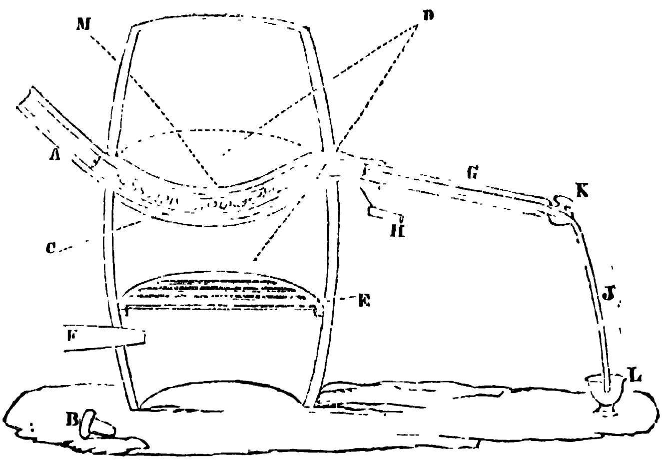
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 80.] SATURDAY, MARCH 5, 1825. [Price 3*d.*

"How unhappy would man be without an interchange of thought! The mind would be as riches coffered; their shining beauties eternally buried and prevented from beneficially circulating among society."—*Spectator.*

DR. JOHN'S APPARATUS FOR DECOMPOSING POTASSIUM.



SIR,—In a former Number of your justly popular work, I observed a query on the best method of procuring Potassium, and I hoped, long ere this, to see it answered.

About fourteen years since, I published a paper on the subject, accompanied with an engraving of the apparatus, in Tilloch's Philosophical Magazine; and I am informed, that the greatest quantity of potassium now prepared for sale is supplied from an apparatus of this description, under the direction of a gentleman who at that period assisted me in making my experiments. It is at this day sold in the shops at eight pence per grain, being at the rate of *sixteen pounds sterling per ounce* Troy! or about *four times the price of gold.*

As an encouragement to others to persevere in these pursuits, I shall be excused in saying, that the publication of this paper gained for its author an introduction to the leading scientific men in the United States of America; and that the potassium obtained in the experiments described, was carried by me to that country in the following year, where I had the pleasure of exhibiting this curious substance to a great number of persons who had no previous knowledge of it but by report. I had also the good fortune to carry some of it to Calcutta. I believe, the first person in America who

obtained potassium, and who was induced to make the attempt after seeing some of mine, was Judge Cooper, of Pittsburgh, Pennsylvania—a gentleman well known for his scientific pursuits, as also in being the translator of the Laws of Justinian, and standing in some relationship to the amiable and philosophic Dr. Priestley.

I have unintentionally deviated from the purport of this communication; I shall now confine myself to the substance of the paper before-mentioned, and prefix a drawing of the apparatus, in the hope of stirring up (through your extensively circulated Journal) some of your readers to fresh inquiries on this truly interesting subject.

Early in the year 1810, wishing to decompose potash with the bent gun-barrel, as was then done at the Royal Institution in London, and not enjoying the ample resources of its excellent Professor of Chemistry, Mr. (now Sir) Humphry Davy, it became a desideratum to construct an apparatus which should serve for the repetition of the experiment, instead of cutting it in pieces, as by the method hitherto in use.

Description of the Apparatus.

I procured an old gun-barrel, which cost me about two shillings; one end of it was curved, so as to correspond with the size of the furnace to be employed; the straight portion was bent so as to incline a little, and then cut off within an inch or two of the curved portion, to which it was afterwards made to fit air-tight by a ground joint. Within the junction I introduced a thin iron tube, which serves to receive the potassium just as it emerges from the furnace, thereby affording facility for removing it, and obviating waste. To the other end of the curved portion is ground a short tube of iron, a *small* hole only being left for communication between it and the bent part of the apparatus; its upper part was furnished with a ground iron stopper, to be employed at the end of the process. The furnace I used was constructed of the common black lead crucibles, about eight inches in diameter; the fire was urged to its proper degree of intensity by a pair of double bellows, 36 inches by 14.

Method of using the Apparatus.

Previous to the commencement of the operation, the curved piece is to be separated from the rest, and covered with a luting of Stourbridge clay and chopped straw, sufficiently diluted to be applied, in successive layers, with a common painter's tool, taking care that each coat be dry before another be added, otherwise the lute will fall off in the experiment, and the iron be melted. The curved piece of barrel is next to be filled with clean iron turnings, obtained without the use of water, which would perhaps altogether prevent success in attempting the decomposition of the alkali. The long straight piece is now to be joined to it (having placed the small thin tube within it); at the end of the straight part I generally affixed a stop-cock, and to it, by means of a cork, a bent glass tube, which passes into a cup of oil placed on the ground, and thus cutting off all communication between the barrel and the external air on this side. At the opposite end, the smaller straight tube is to be put on; and now the fire should be gradually raised till the iron turnings are seen, through the small hole, of a white heat. No time should be lost in bringing this lesser tube to a red heat, which is done my means of an auxiliary fire applied to it. The potass is now to be gradually introduced, and as fast as it melts, and passes down on the turnings, is to be supplied successively, till the quantity intended for the process be spent, when the iron stopper should be put in, and a little of the luting applied, to prevent the possibility of the access of air: the stop-cock must now also be turned, or the oil would rush up, and endanger both the product and the operator. If the process has gone on well, hydrogen gas will be evolved in great abundance from the end of the glass tube in the oil, and not unfrequently containing potassium in solution, which takes fire of itself in the air, affording a pleasing appearance. The fire may now be removed, and the apparatus suffered to cool. If the experiment be successful, the potassium will be found in and about the thin iron tube, which, on the opening of the apparatus, should be plunged into naphtha, and what more is about the sides of the barrel should be expeditiously collected for the same purpose. I should have mentioned that it is necessary to keep the straight part of the barrel as cold as possible by wet cloths.

Remarks on the Process.

In my first attempt I obtained twenty grains of the metalloid; in the last, from an apparatus which I had used twelve times, I collected 140 grains from eleven drachms Troy of the alkali. My next object was to substitute, if possible, the common caustic potass (*kali purum*, or *lapis infernalis*), which is sold at an eighth of the price of the pure potass, and which, up to this time, had been always employed. In a subsequent experiment twelve drachms yielded the extraordinary product of 170 grains.

Having a wish to obtain *sodium*, as well as potassium, but not succeeding with caustic soda alone, I employed two drachms of soda with six of potash, and obtained sixty grains of a beautiful com-

pound, nearly fluid, and of a brilliant lustre, resembling quicksilver: it appeared of the same specific gravity as the naphtha in which it stood suspended.

In another experiment, in which I used one drachm of soda to seven of potass (the proportion, I believe, then used by the present Sir H. Davy); from ten drachms of the mixed alkalies I procured 150 grains of the mixed metalloids, resembling quicksilver, but with this difference that it floated on the naphtha.

Should any of your more scientific readers wish to consult the original paper, it may be seen in the Philosophical Magazine for 1810, vol. xxxv. p. 321. I have been induced to submit the above remarks to stimulate others. I was greatly indebted at the time to a good workman for my apparatus, and am fully sensible how much improvements in science depend on the artisan as an auxiliary; and I am delighted to think that, through your steady and successful labours, the mechanic is likely to become not only a scientific workman, but, I believe, a better man.

I am, Sir,
One of your earliest Subscribers,
WM. JOHNS, M.D. F.L.S.
Manchester, 14, Oxford-road.

Description of the Plate.

A, the tube for the potass, or potass-holder. When the fire within the furnace is nearly at its proper height, a quantity of burning charcoal should be applied to this part to bring it to a red heat.

B, an iron stopper, to be put into the end of A, at the termination of the process.

C, the iron turnings, over which the potass passing is converted into potassium.

D, the place for the fire, to be made of charcoal, above and below the bent part of the gun-barrel.

E, section of the grate.

F, the pipe entering below the grate, and connected with a pair of double bellows.

G, straight portion of the gun-barrel.

H, a thin tube, to be introduced within the joint of the bent and straight portions to collect the product.

J, a glass tube.

K, a brass stop-cock.

L, a cup of oil.

M, the bent barrel, covered with lute.

MR. COBBETT'S STOVE.

SIR,—Having heard mention lately of a novel kind of Stove, recommended by Mr. Cobbett, in his *Register*, in his usual puffing style, I had the curiosity to call at his shop, a few days ago, to see one, and now beg leave, through the medium of your useful miscellany, to offer my observations and opinion on this Transatlantic *piece of excellence* (so far surpassing all the powers of John Bull's conceptions and inventions in that line), lest any of your readers may be deceived by that figurative writer's blandishments.

First, I am told that this stove was originally invented by Dr. Franklin to burn wood; for which purpose it appears to be more particularly adapted. But how the Americans perform their cooking (if they do cook with such stoves) is to me inexplicable: in fact, as a cooking apparatus, it is completely out of the question, having no convenience either for roasting, boiling, baking, or stewing. Next, as a parlour-stove, it has a heavy, clumsy, stupid appearance, with sides or cheeks projecting into the room, and a large filthy hearth or bottom-plate (projecting also), which, from its construction, must be always dirty, as the fire is made in a recess on this hearth, without bars to keep it together; it is, consequently, unfit to burn coal. Mr. C. boasts of the heat emitted by this stove; I cannot see but that our register stoves are equally as favourable to propel heat, whilst, for convenience or elegance, it has no claim whatever compared with them, nor will it admit of such variations in pattern, style, or designs. Although Mr. Cobbett's stove, too, may be made to burn coal by placing a body, with bars, within the recess, yet it will never be fit to appear in a gentleman's parlour, dining or drawing-room; nor will all Mr. C.'s rhetoric ever bring his *Jonathan* into general use in England, unless he can turn back the national taste a century; for so far back, at least, I date this modern antique.

I am, Sir,
Your very humble servant,
T. J.

[We have, as recommended by our Correspondent, paid a visit to this new wonder of Mr. Cobbett's,

and came away with precisely the same opinion of it. Let us consider, besides, the expense of this proposed *revolution* in our firesides. "A common stove," says Mr. C. "made from my model, and such as is on the first floor at Fleet-street, costs four guineas: a smaller one, such as in the shop in Fleet-street, costs three pounds ten shillings."—"They may be placed to any *chimney already built*. You may take away the fire-box in a parlour, and put up one of these in an hour." Yes, you may; but you have what that fire-box cost you to add to the expense of the new stove, and your only gain, on the other side, will be a very little more heat (even that will be doubtful, if your old stove is a register one), for which you will have utterly sacrificed what has been always considered among the chief recommendations of an English fireside—cleanliness, elegance, and convenience.—EDIT.]

EQUALIZATION OF WEIGHTS AND MEASURES.

SIR—I am requested by the Rule-Manufacturers of Birmingham to write to you for information, through the medium of your Magazine, as to whether the Act for Regulating the Standard Measures of the Country will affect the length of Rules; viz. the one, two, and three feet Carpenters' and other Rules? And to inform what is meant by the Imperial Rod, and what the expense of it would be?

I am, Sir,
Your obedient servant,
ROBERT BOWELL.

Birmingham, Jan. 27, 1825.

There is no doubt that the new Act will affect the length of Carpenters' Rules, as well as all other standards of measurement in use throughout the country.

The first section of the Act enacts, that "from and after the 1st day of May, 1825, the straight line or distance between the centres of the two points in the gold studs in the straight brass rod, now in the custody of the Clerk of the House of Commons, whereon the words and figures, 'Standard yard, 1760,' are engraved, shall be, and the same is hereby declared to be, the original and genuine standard of that measure of length or lineal extension called a yard; and that the same straight line or distance between the centres of the said two points in the said gold studs in the said brass rod, the brass being at the temperature of 62 degrees by Fahrenheit's thermometer, shall be and is hereby denominated the 'Imperial standard yard,' and shall be, and is hereby declared to be, the limit or only standard measure of extension, wherefrom or whereby all the measures of extension whatsoever, whether the same be lineal, superficial, or solid, shall be derived, computed, and ascertained; and that all measures of length shall be taken in parts or multiples, or certain proportions of the said standard yard; and that 1-3rd part of the said standard yard shall be a foot, and the twelfth part of such foot shall be an inch," &c. &c.

The "standard yard" here referred to is declared farther to be precisely analogous to a certain *invariable natural standard*, which is thus described (section III.) :—

"And whereas it has been ascertained by the Commissioners appointed, &c. that the said yard, when compared with a pendulum vibrating seconds of mean time in the latitude of London, and a vacuum at the level of the sea, is in the proportion of 36 inches to 39 inches, and one thousand three hundred and ninety-three ten-thousandth parts of an inch."

By section 12, the Justices of the Peace of every county, riding, &c. and the Magistrates of every city, town, &c. are ordered, within six calendar months after the passing of the Act, to procure, for the use of their respective jurisdictions, a model of the said standard of length, and each of the parts and multiples thereof, &c.

It is farther enacted, by section 15, that from and after the said 1st of

May, 1825, "all contracts, bargains, sales, and dealings, where no special agreement shall be made to the contrary, shall be deemed, taken, and continued to be made and had, according to the standard weights and measures ascertained by this Act." And by section 16, that it "may be lawful for any person or persons to buy and sell goods and merchandise by any weights or measures established either by local custom, or founded on special agreement, *provided always*, that, in order that the ratio or proportion which all such measures and weights shall bear to the standard weights and measures established by this Act, shall be and become a matter of common notoriety, the ratio or proportion which all such customary measures and weights shall bear to the said standard weights and measures *shall be painted or marked upon all such customary weights and measures respectively*."

The Lords Commissioners of the Treasury are finally directed to cause "accurate tables" to be "prepared and published," "showing the proportions between the weights and measures heretofore in use, and the weights and measures now established, with such other conversions of weights and measures as the said Commissioners may deem to be necessary."

It now appears, however, that neither the models required to be transmitted to the different counties, cities, &c. nor the tables ordered to be prepared and published by the Lords of the Treasury, can be got in readiness by the time the Act was appointed to come into operation, namely, the 1st of May next; and that the general equalization of weights and measures thus ordained will therefore require to be postponed for (probably) another twelvemonth.

A Mr. Gutteridge, of the Excise, has in the meanwhile commenced the publication of a "Set of Tables of all the measures of capacity used, generally and provincially, within the dominions, at home and abroad, of the British Empire, as collected by orders of Government; and the wine, ale, Irish, and Winchester measures, actually shown in Imperial measure, as required by Act of Parliament; together with a variety of other tables upon the same subject."

The first set of these tables, being all that is yet published, is now before us. It includes tables of equalization and conversion from English wine gallon, English ale, Irish liquid, and English Winchester measures, to the Imperial standard. The system on which these tables has been constructed is very plain and perspicuous; and, from the strong manner in which they are recommended for practical use, by several individuals of scientific eminence, by whom they have been examined, we doubt not that the computations are of corresponding accuracy.

For the better information of our Correspondents, "the Rule-Manufacturers of Birmingham," and of our readers in general, we shall extract from Mr. Gutteridge's book what he entitles, "The Rationale of the Imperial System:"—

"Take a pendulum which will vibrate seconds in London, on a level of the sea in a vacuum; divide all that part thereof which lies between the axis of suspension and the centre of oscillation into 391,393 equal parts; then will ten thousand of these parts be an imperial inch, twelve whereof make a foot, and thirty-six whereof make a yard.

"Take a cube of one such inch of distilled water, at 62° of temperature by Fahrenheit's thermometer; let this be weighed by any weight, and let such weight be divided into 252,458 equal parts; then will one thousand of such parts be a Troy grain, and seven thousand of these grains will be a pound avoirdupois, the operation having been performed in air. Ten pounds such as those mentioned of distilled water, at 62° of temperature, will be a gallon, which gallon will contain two hundred and seventy-seven cubic inches, and two hundred and seventy-four one-thousandth parts of another cubic inch."—EDIT.

RAW AND BOILED EGGS.

Sir,—The other night, on returning from the toils of the day, I felt inclined to step into a coffee-room to take a little refreshment. I entered a box where a number of persons were disputing about a problem in mechanics. The arguments upon both sides appeared to me the most foolish and unsatisfactory I had ever heard. After a great many pro's and con's, I was very politely asked to give my opinion, which, in my stammering way, I did not hesitate to do; but it was so much at variance with the *tea-cup philosophers* on both sides, that my ears were instantly assailed, not, indeed, with blows, but with a sound not unlike the buzzing of hornets, "when plundering herds assail their like;" and in the uproar I could distinctly hear the word "*Scotsman*" repeatedly echoed. But to the point in dispute. It appears that one of these gentlemen (a disciple of Epicurus, I presumed, rather than a follower of Plato or Archimedes) had bought some *eggs!*—they were laid upon the table, and, for want of better employment (for there were plenty of books in the room) *amused himself with whirling round an egg!!* upon its side. This he found attended with considerable difficulty, for he could not make it revolve above three or four times; but, after they were boiled, he made the *grand discovery* that it whirled round with ease, the number of revolutions increasing as the force. The cause of this disparity was the case in dispute. When once I hear what your readers have to say about it, I will given you my opinion.

I am, Sir,
Your obedient servant,
Nicol Dixon.

Red Lion-street, Clerkenwell.

LONDON READING ROOMS AND LIBRARIES.

Sir,—I think your Correspondent, Keysoe, (p. 309, vol. iii.) will find what he wants in the London Institution, Moorfields, as there he will meet with an excellent library, and have access to it from, I believe, eight in the morning until eleven at night, and he will have the benefit also of all the principal daily papers, with the periodicals. This, I think, will suit Keysoe best, as he requires a place to read in, otherwise he might subscribe to a circulating library, where they would send him books out of town. There is a reading-room at the Auction Mart, but no library will be formed till they have 300 subscribers. I have endeavoured, without success, to procure a prospectus for him, but there are none printed. Keysoe would be able to guard against buying catchpenny books, if he were only to pay a little attention to any of the numerous Reviews with which the town abounds,* and who very faithfully guard their readers against positive *trash*. Some short time since a number of reading-rooms started up in various parts of the town, but they were only the creatures of a day. One still exists, at Stuart and Panton's, Cheapside, and I should think they have a collection of books sufficient to meet the extended wishes of Keysoe.—Hoping this will be the means of satisfying him,

I am, Sir,
Your obedient servant,
T. M. B.

A COACH LIGHTER WHEN IN MOTION THAN AT REST.

Sir,—As I find no periodical publication so accommodating to the wishes of the public as the Mechanics' Magazine, which, were it discontinued to-morrow, would, I am persuaded, be very generally regretted, I take advantage of the facility it affords of obtaining information generally, to request of some of its Correspondents the favour of stating their opinions on a subject, trifling, to be sure, of itself, but which has excited very considerable interest among a few friends who meet weekly for the purpose of discussing subjects of a philosophical nature. The question which has elicited much diversity

* Such, particularly, as the Literary Chronicle and Literary Gazette.—Edit.

of opinion is this—Why does a coach in motion press a weigh-bridge less than when it remains on it in a state of rest? To simplify the proposition as much as possible, we have agreed to word it thus—Why does a cannon-ball press a weigh-bridge more when it is at rest than in motion? or, how is gravity suspended by motion? One maintains strongly that the *vis inertiæ* of the ball being the cause of the ball moving along the bridge or scale, it acts against the weight of the ball, and thereby lessens the weight equally as when, from the same cause, the ball ascends in the air when the entire weight of the body is destroyed, as if the ball, instead of pressing down a scale, rose out of one. The President advances that the weight is noways reduced; that the ball is as heavy in motion as at rest; but that the force which it possesses, from the quantity of motion within it, being so much greater than its gravity, the effects of the force prevent those of gravity being sensible. To this it was objected, that gravity being rendered insensible, does not account for the phenomenon, as it leaves the question at issue unanswered, viz. how is gravity suspended by motion? The third opinion we have had proposed is, that motion could not have the effect of suspending gravity, or the planets would not move in curved but straight lines. While the Secretary suggests, that the reduction of weight or pressure on the bridge renders it evident there is no such thing as gravity; as the suspension of gravity involves the absurdity of the motion of one, overcoming the attraction of the earth, or of millions of millions; and that, as nothing can take away weight but the cause of weight acting in the contrary direction, the weight of the cannon-ball, in the first instance, can be but the effect of some medium which is in motion pressing the ball towards the centre; which medium, in the second instance, presses it in the direction of its motion over the bridge, as well as in that of its radius to the centre of the earth, leaving the downward pressure of the ball on the bridge equal to the entire weight of the ball, less the horizontal momentum.

There being three rumps and dozens, as well as the honour of the Chair, depending on the above, we have agreed to refer to you, Mr. Editor, to obtain for us a correct and (if possible) a speedy decision of a question, the *gravamen* of which is obvious.

I am, Sir, &c.

SAM. YELSAP.

FLAVOURING BRANDY.

SIR,—In reply to an inquiry relative to "what is used to flavour Brandy," your Correspondent, Bibo, in Number 50, pays but an indifferent compliment to the taste of John Bull, when he intimates that brandy, to please him, must be deteriorated with sugar. He tells us, that "if the inquirer wishes to know what is used to flavour that abominable compound called British Brandy, 'he could a tale unfold,' but that he has a high respect for certain individuals called chemists, distillers, and others, whom such an exposure might injure."

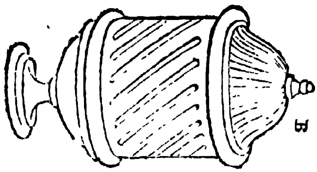
Really, without meaning any offence to Bibo, I must say this is a singular predilection to profess (unless, indeed, he be himself one of those manufacturers of the abominable compound which he stigmatizes so justly). If he be not one of the fraternity, is he not rather sacrificing the welfare of the many to the "poisoning prosperity" of the few? I conceive the great bulk of your mechanical and operative Correspondents are but little obliged to Bibo, who could, it seems, save them from poisoning, but that he loves the poisoners better.

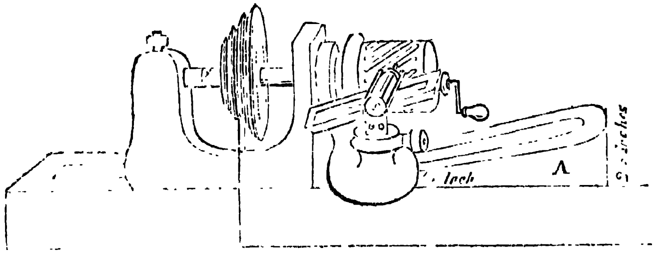
I am, Sir,
Your humble servant, but
NO CHEMIST.

February 17, 1825.

P.S. May I beg any of your Correspondents, possessed of less "feeling for chemists and distillers," to communicate the process of making that "abominable compound," British brandy.

NEW MODE OF FLUTING.





SIR,—As the Art of Turning contributes so much, at present, to the amusement of many gentlemen, and as the variety of patterns to be formed by the use and application of the common lathe is rather limited, I submit the following mode of Fluting, as offering a little variation to that in common use, which is performed horizontally. First, prepare a wedge of beech wood, two or two and a half inches at one end, and sloped down to half an inch at the other; place this under your sliding rest, so as to give it such an inclination as you may wish, and in this simple way commence your fluting from left to right, and your flutes will have an inclination, as figure B, which is a rough design of a vase, and looks very pretty, if well done.

I am, Sir,
Your obedient servant,
W. J. C.

Brompton-row, 20th Dec. 1824.

GUNN'S IMPROVEMENT IN CARRIAGES.

SIR,—I am happy to have this opportunity of acknowledging the useful information I have often received from the constant reading of your truly instructive Magazine.

I confess I was rather surprised to read, in your 75th Number, an article to which it is my duty and also my interest to reply. I do sincerely thank your Correspondent (A Stage-Proprietor) for his advice as regards the publishing a description of my improvements on Wheeled Carriages, and earnestly entreat his patronage, should he deem them to be worthy of adoption, as I am building a coach, which, I hope, will be complete in a few weeks. Whatever has been stated of the security afforded to property, too much was not said: personal safety might have been added with equal propriety, as the coach cannot be robbed or upset. My improvements are applicable to all carriages, public or private; and, from their nature, I am enabled to build considerably lighter, embracing the advantage of crane-neck carriages, without adding to the length of the present stage-coaches between the axletrees; at the same time building much lower than is possible on the plan now used, and avoiding the necessity of carrying luggage on the roof,

having more roomy boots; all those advantages, besides having higher wheels in front, may be effected without additional expense, and, I hope, ultimately at a great reduction in price.

If your Correspondent, or any other Gentleman, wishes for further information, I will be happy to wait on them with my model and drawings, or they may view the coach now making by addressing me. To account for not giving earlier information to the public, I beg to state it was my intention to have produced the coach before I in any way submitted its qualifications for their approbation. If your Correspondent or other readers think I have, on being publicly called on, said too much in its favour, they will, at the same time, perceive that I do not fear, but rather court inquiry. Hoping every allowance will be made for the desire I have, in common with other inventors, for the approbation of the public,

I am, Sir, yours, &c.

J. GUNN.

4, Hart-street, Grosvenor-square.

P.S. I might enumerate what I term my minor Improvements, and which may be applied to any carriage, without using my peculiar construction; but I fear I have already too far trespassed on your valuable pages.

FRENCH MACHINE FOR TAKING MERIDIAN LINES.

Fig. 1.

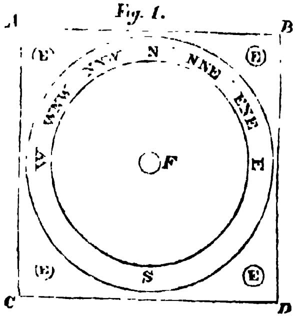
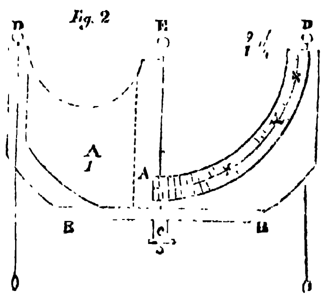


Fig. 2



SIR,—One of the objects of your valuable Magazine appears to me to be, the giving publicity to whatever tends to facilitate the march of science, either by the revival of old, or the production of new instruments.

About fifty years ago, I bought, in Paris, for twelve livres, a Machine for taking Meridian Lines. Not having met with one similar to it, either in simplicity of workmanship, or low value of material, I send you the accompanying rough, but I hope intelligible draft of it, and remain,

Your obedient servant,

ARCHIBALD HAMILTON ROWAN.

Leinster-street, Dublin,
11th Jan. 1825.

DESCRIPTION.

Fig. 1.

ABCD, a plateau of wood, with four screws, E, to bring it to a level; a circle of paper glued in it, with the points of the compass; F, a hole to receive the neck of the second part to traverse in; nut, &c. at bottom.

Fig. 2.

A is the machine, made of three pieces, I suppose to prevent warping, marked by dotted lines. It stands nine inches above the plateau, and is 13½ inches from out to out of the horns, which, at D, are three-eighths of an inch; the thickness is one inch and a half. On A 1 is a paper glued on, divided into 90°; D are two screws, round which are passed silk threads, with conical plummets at the ends overhanging, and regulated, as to perpendicular, by lines marked on the ends of the machine. E is a swinging eye-

glass, fixed at right angles, so as to receive and transmit the sun's image on the graduated line. To use it, mark the degree where the sun's image is subdivided by the lines of degrees; lower the screw, E, and mark the point of incidence of the plummet, remarking also the height of the sun on the line of degrees before noon; then turning the upper part on its axis, the bottom remaining steady, so as to catch the sun's image in the afternoon at precisely the same height on the scale of degrees, mark that point also, with each plummet, as before; remove the machine; join the two points made by each plummet, bisect each of these lines, join the points of bisection, and that line will be the meridian line of that spot.

SODA WATER MANUFACTURE.

Sir,—In the 61st Number of your Magazine, Mr. Marsh favoured your readers with a drawing of an ingenious apparatus for making Soda Water. Can he inform them, through the same medium, how far this apparatus is approved by those who have used it? what it will cost? and where it may be purchased? Could Mr. Marsh or any other gentleman favour the public with a description of the soda water apparatus manufactured by Mr. King, successor to the late Mr. Leatherbarrow, of Liverpool?

I am, Sir,

Yours truly,

Drug.

Newcastle-upon-Tyne.

FIRE-DAMP — THE DAVY — VENTILATION.

Sir,—Having seen a plan in your Mechanics' Magazine, Number 76, page 316, by a Staffordshire Land-drainer, for purifying Coal Mines from Choke-damp, I found by reading on, that what he calls choke-damp, we here call inflammable gas or fire-damp. I myself am a land-drainer, and, in the course of my regular business, sometimes get in contact with this troublesome thing, fire-damp. I am led to believe that not any scheme, either mechanical or chemical, will ever equal good ventilation. Even Davy's *safety* lamps do not always deserve the name, for, by trusting to them so often, I fear proprietors of mines and their agents are put off their guard, and led to save expense and trouble in ventilation, the want of which has been the cause of several of those dreadful explosions that have recently taken place, and have swept some mines with "the besom of destruction." I have never seen a good current of air made to pass always the same way by an air furnace (by no means *without*, as the air would circulate sometimes one way and then the other, unless there were a regular draft by the air furnace): there will be always forward workings in all extensive coal-mines, that it may not be practicable to convey the current of air to. These, too, will generally be distant from each other, and the openings not of such magnitude as to contain a body of gas so destructive as is sometimes the case, for the current of air would check it the moment it reached its thoroughfare. In those leading or forward workings, the Davy's lamp may be useful. I myself have had some hairbreadth escapes, and have lost a near and dear relative by one of these explosions; and, well knowing the cause of it, when I hear and see would-be philosophers talk and write, and again, time after time, hear of mines being swept with this dreadful scourge, I am led to say,—"Miserable comforters are ye all!"

Will you, Sir, have the goodness, by placing this in your Magazine, to get a little explanation from your Correspondent, "The Staffordshire Farmer and Land-drainer," with regard to his plan of purifying coal-mines? I wish him to explain by what method he would bore a six-inch hole from the breast of the mine upwards to the surface, as we, here, in South Wales, are working under mountains a mile and a half deep from the mouth of the mine, and sometimes 500 yards below the mountain top. He tells us he will work the boring-rods by levers and pulleys, but, as philosophers can better talk than do, I beg to ask him, HOW?

Suppose, by some miracle, a hole were bored from the back of these mines upwards to the surface, how

is the gas to escape up such a hole, when, nine times out of ten, the hole would be full of water running down it?

What, pray, is to move the sedan chair, with two men shut up in it, forward and backward? and what is to become of his two Jacks in the box, when they have set fire to a large body of inflammable gas, with *his pistols and serpents?* I know, right well, weak gas may be fired safely enough, and it is done almost daily; but we have, invariably, a current of air at hand to escape to. There is often, however, such a quantity accumulated, that to fire it would be certain death to the person so employed.

As to your Correspondent's bellows, nozzles, stop-cocks, hose, brass tubes, air-pumps, funnels, long leather flexible pipes, &c. &c. I shall leave them to the consideration of his neighbours, the Staffordshire underground land-drainers, as, no doubt, many of them would be glad to know their use.

I am, Sir,
Your humble servant,
A South Wales Under-ground Land-drainer.

WOOD LIES UNDER WATER.

Take two pieces of wood, planed perfectly smooth, so that no water can get between them when their smooth surfaces are put together; cement one of the pieces to the bottom of a glass vessel, so as to have its' smooth side uppermost; then place the other piece above it, and hold it in this situation till the vessel is filled with water, and it will be found to lie at the bottom as quietly and firmly as if it were a piece of lead or stone.—*Chemist.*

THE "QUESTIONS IN SCIENCE."

Sir,—The answer to your Correspondent, C. D. Y.'s query (p. 331, vol. iii.) respecting the variations in the atmosphere's weight, is,—that while the earth's attraction (the cause of weight, as he terms it) is always the same, and the force with which it acts is in proportion to the quantity of matter attracted and the square of its distance, the weight of the atmosphere must necessarily vary from the changes in its density produced by its ever-varying temperature, and the equally varying quantity of moisture with which it is charged. Every variation of the barometer is accompanied by such changes, which are manifested by their effects on the thermometer and hygrometer.

His second query may be answerable in two ways, according to the sense in which it is taken.—Wherein does chemical combination consist? Chemical combination consists in this—that two bodies brought together unite and form a third, having properties dissimilar to those of the separate bodies. But your Correspondent means—What is the precise nature of the change a body undergoes when chemically combined? Now some believe that bodies are then only minutely divided and intimately intermixed, as your Correspondent seems to do. But I think this is not sufficient to explain the changes which take place in bodies, in their affinities, electrical states, capacity for caloric, and particularly their effects on animal bodies. The real state of bodies chemically combined, is, I conceive, perfectly inexplicable, as much so as the reason why bodies expand by heat.

I am, Sir,
Your obedient servant,
J. G.

P. S.—Your Correspondent would do well to reconsider what he has said about a humming-bird moving a planet.

Sir,—"A Question in Science," in your highly useful little miscellany, Number 77, page 331, has reproved me not a little for my indolence, for I find myself anticipated in a case that once occupied my thoughts in no slight degree; and I assure you the answer which I now trouble you to insert to the question of C. D. Y. I copy from a paper I had written two years since, and which, from its seeming to cast a doubt on established

opinions, I have timidly withheld from offering to be published, although you have politely inserted others of mine which (now I am persuaded) are much inferior to it, at least so far as scientific information is concerned.

"The inertia of matter, and matter being not only indestructible, but unalterable, afford sufficient data from which to conclude that chemical combination differs from chemical or intimate mixture, only in this, that one, at least, of the bodies concerned suffers dissolution, so that its elements, and in the uncombined elementary state, unite with the other body; whereas chemical mixture consists in parts of one body mixing or uniting with parts of another, in consequence of extreme subdivision, but not elementary separation, having taken place."

The premises of C. D. Y. evidently lead to the like conclusion; but *essential change*, I presume, he does not maintain.

I am, Sir, yours, &c.

P. H.

GAS LIGHTS IN THE NAVY.

Sir,—In page 328, of No. 77, I observe some rather ingenious hints thrown out respecting the practicability and utility of introducing Gas Lights into shipping; and, really, if it can be done without the trouble of fining, and the incumbrance of a gasometer, it appears to me that the principle may be taken advantage of, so as to prove beneficial in more ways than one, particularly as respects *night-signals*. Coloured glass globes, for the protection of the flame, with difference of position, afford all necessary changes; and the size of the volume of flame best suited to the occasion being at command, while the comparative value of gas-flame for such purposes over flame otherwise obtained, being too well known and admitted to need recommendation, I cannot but think the suggestion worthy of being taken up by the Admiralty of the kingdom; and, in order to perfecting a system of night gas-signals, recommend a reward being now offered for the system the most complete, including all that relates to time, weather, and propriety in every respect; so that, whenever war should break out, we may have all the advantages of previous experience in this great essential.

I am, Sir, yours, &c.

T. Hartshorn.

MATHEMATICAL KNOWLEDGE USELESS WITHOUT PRACTICAL EXPERIENCE.

Sir—In the very elaborate Lecture of M. de Reaumur, on the Strength of Ropes, page 324, Number 77, I observe one of those sensible remarks which discovers clearer ideas of the nature of things than the general style of philosophers permits us giving them the credit of being acquainted with. I beg to refer the reader, for connexion, to the paper itself. It goes on thus :—"On this geometry throws no light, any further than we make arbitrary suppositions, which, consequently, determine nothing." These arbitrary suppositions, this premature application to geometry and mathematics, has done incalculable injury to science. Thus the mathematician, by *his* science, announces wherein the *cause* of planetary motion consists, because the time of an eclipse happens to be discoverable by calculation and observation, as if the cause of impulse were capable of being deduced from the peculiar curve which the trajectory of a projectile describes; and, again, this assumed discovery of the cause of planetary phenomena being supposed all-sufficient to account for minor changes, all terrestrial phenomena are accounted for as effects of the same cause, and the mathematical application coinciding, in consequence of being deduced from existing phenomena, the existence of attraction is, as it were, mathematically demonstrated, though, after all, it is a mere blindman's-buff guess, attraction being a name for nothing: *for, as matter is absolutely inert, to be so, and have the power of attracting at*

the same time, is utterly impossible. In the science of optics there are many most glaring instances of the arbitrary conclusions, drawn from what may be termed mathematical inferences, of the nature of bodies, of the introduction and perpetuation of error on mathematical principles. Scarcely has the word "light" been mentioned, before the mathematical proof of the velocity of light is set down as an incontrovertible fact, which is as quickly followed by an angle, expressive of the mathematical certainty of the reflection or refraction of light; while to this instant it is, and ever must remain unproven, that light is any thing substantive, or other than a state of mental consciousness. This does not arise from mathematics being productive of error, but from the physical existence and nature of things being supposed to be deducible by that sublimest of all sciences, and the only one which is founded in nature.

In the next place, the operative, unlearned mechanic imagines, that between him and the now-a-days *mathematical master*, there must be a necessarily awful difference in their conception of things; as if the latter thought in Greek or Hebrew, to which, of course, the former could never attain; and therefore he concludes that he should have no confidence in his own opinions. But what can the kingly mathematician do, without the basket-making mechanic? What has not been done already by men who were all their lives totally unacquainted with even a single proposition in Euclid? And what is the greatest mathematician, practically inexperienced, to the unlearned mechanic, who knows how to raise the most complicated fabric without applying for mathematical aid? Still the perfection of the arts consists in the man, as well as the master, being possessed of scientific knowledge, as an *appendage* to *operative* skill, instead of being operative only, or mathematical only. The mechanic is misled, if he imagine that the orders he receives are mathematically pure, and such as native genius and understanding cannot soar to. On the contrary, let him be assured of this, that in *his* calling he can learn some, but can communicate more.

I am, Sir,

Your obedient servant,

D. Y.

RAILWAYS.

To set at rest a question which has of late been a good deal agitated, with respect to the effect of the velocity of a carriage, in diminishing or increasing the degree of friction on Railways, Mr. Roberts, of Manchester, has made the following experiments:—He procured a cast-iron drum or flat hoop, six inches broad and three feet in diameter, which was made to revolve vertically (like a grindstone) by a pulley and strap. This served the purpose of a railroad. A small wagon with four cast-iron wheels was placed exactly on the top of this drum, and attached on one side to an upright post, forming part of the wooden frame which supports the drum. It is attached to this post by one of Mariott's patent weighing machines, for the purpose of measuring the friction. To ensure greater accuracy, a tempering screw was employed, by which the centre of the wagon could be kept at all times exactly over the axis of the drum; in order that no part of the weight of the wagon might be blended with the pressure produced by the friction. As a farther precaution, a wooden board was so placed on one side of the wagon as to prevent the disturbing action of any current of air generated by the motion of the drum. Now, if the drum is made to revolve with any velocity, say four miles an hour, and the wagon is held in its place, it is perfectly obvious that the wheels will turn on the surface of the drum, precisely in the same manner as if the wagon had moved along a flat railroad; and the friction will be the *same*, excepting a minute addition occasioned by the curvature of the drum, but which will not affect the relative friction at different velocities. This will be accurately exhibited by the index of the weighing machine, against which the wagon pulls with a force equal to the friction. The experiment has this grand advantage over those made on level roads, that the resistance of the air is entirely got rid of. The apparatus being adjusted, and the wagon loaded with fifty pounds (including its own weight), the periphery of the drum was made to revolve 'at different velocities, varying from *two to twenty-four miles an hour;*' but 'in every case *the friction, as indicated by the weighing machine, was precisely the same.*' And that there was nothing in the construction of the apparatus to

produce a fallacious result, was evident from this, that though no increase of speed affected the index of the weighing machine in any degree, it immediately showed an increase of friction, when an addition was made to the weight.

THE CORKED BOTTLE SUNK IN THE OCEAN.

SIR,—I beg the favour of being allowed, through the medium of your widely-extended Magazine, to request of some of your intelligent Correspondents a minute description of all the circumstances attending the sinking a well-corked bottle a considerable depth in the ocean. The experiment is almost always performed for the amusement of passengers during a long voyage; so that, doubtless, many who have witnessed it will feel pleasure, on reading this, to gratify the writer's wishes, which, he assures the reader, are not the result of an idle curiosity, or for the purpose of being able to perform the same before ladies and gentlemen, but solely as a matter of scientific investigation; and hence it is that he requests nothing may be omitted in the description he may be favoured with.

I am, Sir,

A CONSTANT READER.

INQUIRIES.

NO. 102.—BRONZING.

A young Brassfounder, in Sunderland, will thank any of his senior fellow-tradesmen who will give him a recipe for making Bronze, such as used for brass tubes, &c. in Birmingham? Also, through what medium he can be supplied with good lacker?

NO. 103.—WATER RECLAIMED FROM THE SEA.

A Correspondent would be glad of any information respecting the possibility of applying, on land recently covered with sea-water, but now dry, an antidote to the effect of the salts with which the land has been fully saturated during a week?

NO. 104.—STAINING MAHOGANY.

Which is the best and most effectual method of making a good staining oil for soft-grained Honduras and dark Spanish mahogany?

NO. 105.—NEW IMPERIAL MEASURE.

SIR,—By a recent Act of Parliament, the imperial standard gallon is to contain 277.274 cubic inches. Admit that a brassfounder is employed to make a quart, pint, and half-pint measures, to contain in proportion to the above standard gallon, their shape to be that of an inverted frustum of a cone, to fit into each other nicely, so as to be all even at the top; the top diameter and perpendicular depth of each to be equal to the bottom diameter in proportion to the top as 7 to 10. Required the inside dimensions of each, the thickness of the metal at the bottom and top, and the thickness of the bottoms; the outside of the quart measure to fit into a two-quart measure of the same proportion.

I am, Sir,

Your obedient servant,

Jan. 19th, 1825. T. H.

SIR,—If any of your practical Correspondents, through the medium of your valuable and widely circulated Magazine, would answer the two following queries, they would much oblige your constant reader,

T. TENRULE.

NO. 106.—SPIRAL SPRINGS.

I have a Spiral Spring that has one foot range, requiring a ton's weight fully to compress it, acting in a cylinder three inches in the bore, by means of a rod one inch in diameter, terminated by a nut or piston, and wish to know whether such

spring, formed of a cylindrical or of a flat wire, will be stronger, and what is the most perfect method of tempering them? Also, what are the relative advantages of a small or great number of turns in a spiral spring on the above scale, and, with the said range, what distance ought one turn to be from another, and how ought the thickness of the steel to be proportioned so as to unite durability, facility of manufacture, and strength?

NO. 107. — THE CONSTRUCTION OF CYLINDERS.

I am also desirous of finding a rule for calculating the thickness of a cylinder whose internal diameter is given, so as to make its strength proportional to that of a given rod: as, for example, say, a rod of wrought iron, of one inch in diameter and a foot in length, and a soft cast iron cylinder of equal length, and three inches in the bore, what should be the thickness of metal in the cylinder to make it of equal strength with the rod?

ANSWERS TO INQUIRIES.

NO. 97.—QUESTIONS IN GUNNERY.

Sir,—In answer to the Questions on Gunnery, No. 97, I beg to observe that the height of the powder in the barrel entirely depends on the construction of the patent breaches, some of which are chambered out so as to contain nearly the whole of the powder, while others will scarcely take one-eighth. I am enabled to say, from practical experience, that the following will be found a correct statement as to the charge of powder required for the several distances, to carry with strength and truth.

1st. A gun, with a flint-lock, 3-8ths bore, to carry one ounce of shot 30 yards, will take one dram and a quarter of powder.

Ditto, for 45 yards, one dram and three quarters.

Ditto, for 60 yards, two drams and a quarter.

2nd. In answer to the question of mixing two sorts of powder together, I fear the sportsman would reap no advantage; on the contrary, I am of opinion that it would foul the gun much sooner than by using the finest only. Hall's glass powder stands highest in the opinion of sportsmen of the present day.

3rd. Fowling-piece barrels are generally made strong enough to carry ball without injury to the barrel. A 5-8ths bore barrel will take a ball cast from a 20-mould, that is to say, 20 to the pound. It requires a smaller quantity of powder for ball than is generally supposed, viz —

A flint-gun, same bore as above, will carry a ball 50 yards, with three quarters of a dram of powder.

Ditto, for 70 yards, one dram.

Ditto, for 100 yards, one dram and a quarter—the gun to be loaded with punched wadding.

4th. The stub-twisted barrel, with a contracted breach, is as safe and far superior to the common plug, as it brings the priming nearer to the body of the charge, which ignites and explodes much sooner.

A percussion-lock is not so safe for light guns as the common flint-lock, the percussion-powder being so corrosive (notwithstanding some profess to make it anti-corrosive), that, if a gun be left uncleaned for a few days, it eats in and lays a foundation for rust, so that, in a year or so, the gun is rendered unsafe.

The charge of powder varies only in the weight of shot, not in size.

I am, Sir,

Your obedient servant,

Telloc Trigger.

NO. 98—PRESERVING DEAD INSECTS.

Steep them in water wherein corrosive sublimate has been mixed.

R. W. D.

CORRESPONDENCE.

The letter from South Wales, on the subject of executing a Tunnel under the Thames, was forwarded as directed, and we have received the following answer:—"The author of this communication proposes to *lay dry* the bottom of the Thames, by 25 to 50 yards at a time. He must be ignorant of the incessant movement that takes place in the port of London, to imagine that such an expedient is practicable. It is one, too, of upwards of one hundred and thirty plans that were sent to the Tunnel Company in 1809."

LOCK SECURITY.—SIR, I regret to observe, that my letter of the 30th of April last, from Bath, as altered and inserted in your 46th Number, containing an account of an additional security to "Door and other Locks," does not correspond with the sketch sent therewith, or sufficiently so with the one you have published. The dotted lines, *aa*, you have omitted to describe; and, according to your sketch, what they represent is made to appear as connected with the piece, E.* These lines were meant to exhibit a projection from the side, and of a substance with the circular piece, C, being intended as a temporary security to any room-door, having a key-hole only, or a lock that is defective. This piece, *a a*, should be of a sufficient length (when the cross piece, A, is in the key-hole) to bear against the door-post, on the side of which you may be where the door opens from you. This piece, *aa*, is perfectly extraneous in this lock security; but as it makes but a trifling addition to its weight, or inconvenience of carriage, and may prove serviceable, more particularly to travellers on the Continent, where rooms without locks, or, what is equally bad, locks incomplete, are so often to be met with, I think it advisable to those who may use them to have them made thus:—The model I sent you, affixed to a piece of wood, I considered would more clearly define its purposes, as well as its simplicity, although it may have led you (as it appears it has) into error with respect to the section. The letters F and C were not inserted in my letter or sketch, and were, I presume, applied by your draughtsman from the model, as marking the section, C, for the key-hole, and F, as a part of the lock. *This had been well*, had the description corresponded. The projecting piece, D, as placed in your section, would have been placed more in order in the *lower* part of the key-hole, as less liable to interruption from the projecting piece in locks in general. G. M. H——N.

* We can scarcely suppose any person would fall into this mistake.—EDIT.

R. D. will find the Problem he alludes to solved at page 181, vol. II., and illustrated in subsequent papers.

J. W. will find Mr. Pickering's Steam Boiler described in our 29th Number, and a proposed improvement of it in Number 39. An account of Mr. Smith's Apparatus is also given in Number 35; but we are not aware that it can be seen in operation at any place nearer town than Droitwich, Worcestershire.

A "Constant Reader" says, he wishes to construct an organ, but does not know how. He puts us in mind of the man who was in doubt whether he could play on the fiddle, because he had never tried.

A Correspondent wishes the address of Mr. S. Teulon, author of an article in Number 40.

A "Lover of Good Things" had better, before next Christmas, try the effect of the plan he suggests, and inform us of the result.

S. R. S.—Mr. Brunel's Plan of Tunnelling under the Thames is that which is at present in course of execution. We shall be glad, however, to receive the description which S. R. S. offers, of one on an "entirely new principle," "more practicable and less expensive than any that has yet come under observation."

The event which "Aurum" regrets is with us a matter of choice. We feel gratified by his good opinion.

"Philopat" and "G. A. S." are requested to send to our Publishers for letters addressed to them.

Communications received from—Mr. Gouger—Porter—S. E.—An Agent—S. C.—A Constant Reader—O'pinion—A Subscriber—Wm. Andrews—R. K.—Mr. Dickenson—R. D. R.—Cæsar Borgia—W. H. B.

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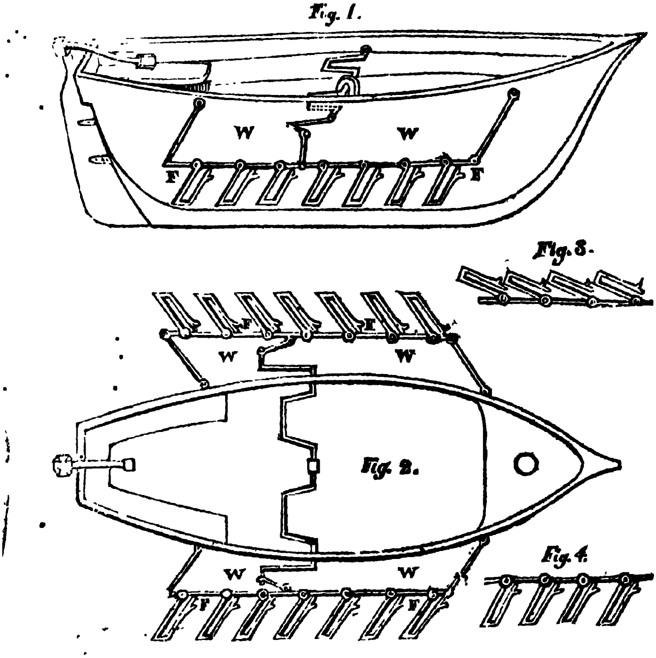
" This is Freethinking: Unconfined to parts,
To send the Soul, on curious travel bent,
Through all the provinces of human thought;
* * * * * *
——— who most examine, most believe." *Young.*

BOAT WITH WINGS,

INVENTED BY MR. DIXON VALLANCE, OF LIBBERTON, SCOTLAND.

" With wings so fitted to each side,
Through briny waves I'll swiftly glide;
Impell'd by steam's all-conquering power,
I'll run at eighteen knots per hour." D. V.

Fig. 1.



BOAT WITH WINGS, ETC.

INVENTED BY MR. DIXON VALLANCE.

SIR,—In the perusal of your valuable Magazine, I have seen several figures of boats propelled with paddle wheels. Now it requires considerable power to turn paddle-wheels in water, as there is a great weight of water to lift on the back-part of the wheel in going round, and the more so the deeper they are, which, of course, greatly retards the forward motion of the vessel. The prefixed drawings exhibit a contrivance of mine for propelling boats and other vessels, by which this drawback is avoided.

Description.

WW represents a jointed wing attached to each side of the boat, wrought by a crank. FF, the fins or feathers of the wings, being pieces of thin wood or sheet iron, from one foot six inches to two feet in length, and eight or ten inches deep or broad. These are loosely jointed to the wing, and, by the forward motion of the crank, fold close to it; while, by the backward motion, they form a strong pressure against the water, and make the boat run swiftly along.

Fig. 1 represents a side-view of the boat, with the crank turned back, and the fins in the act of pressing forward the boat.

Fig 2 shows the wings at each side of the boat as looking down on it, and in the act of pressure against the water.

The fins are so made at the joint as to turn only to the square in pressing against the water, and to fold close up in coming forward, as is shown in figure 3.

Fig. 4 shows the fins in the act of pressure, as has already been described.

I lately made a trial of a model of a boat with wings of this description, and found that it answered exceedingly well. It went much quicker, and with more ease, than with paddle-wheels.

Sails may be applied with more advantage to boats propelled in this way, and the wings will be as easily wrought when deep in the water as near its surface, and may be fitted to a boat for less expense than paddle-wheels.

I am, Sir,

Your most obedient servant,

DIXON VALLANCE

Libberton, near Carnath, Scotland,
Sept. 1, 1824.

WEIGHTS AND MEASURES.

We mentioned in our last, that the operation of the new Act for the Equalization of the Weights and Measures was necessarily postponed till next year; the following documents will explain the cause of the delay:—

Letter from the Commissioners of Weights and Measures, dated the 14th January 1825, to J. C. Herries, Esq. Secretary of the Treasury, transmitting a Report of the Progress made in the Preparation of the Models of the new Weights and Measures.

London, January 14, 1825.

SIR,—I am directed by the Commissioners of Weights and Measures to transmit to you, for the information of the Lords Commissioners of his Majesty's Treasury, the enclosed Report from Captain Kater, stating the progress which he has made in the preparation of the models of the new weights and measures, in pursuance of the directions contained in your letter of the 13th of July, 1824, enclosing a copy of a Treasury minute, dated the 29th of June, 1824, respecting the steps necessary to be taken for carrying into effect the Act 5th Geo. IV. for ascertaining and establishing uniformity of weights and measures.

In consequence of the delay which unfortunately has occurred from the difficulties which have been experienced in the construction of the new bushel-measure, I am further directed to submit to you, for the consideration of the Lords Commissioners of his Majesty's Treasury, the propriety of bringing in a Bill, immediately after the meeting of Parliament, to extend the time fixed by the Act of last Session for carrying the provisions of the said Act into execution.

As Captain Kater now cofidently hopes that the models will be completed and deposited at the Exchequer in the course of the mouth of February, the Commissioners are of opinion, that if the period at which the new weights and measures are to be declared to be the only standards was postponed from the 1st of May, 1825 (the day fixed by the Act of last Session), to the 1st of January, 1826, sufficient time would be afforded for providing the models of the standard weights and measures required for the several counties and corporations of the United Kingdom, and for carrying into effect such of the enactments of the said Act as are preliminary to the general establishment of the new standards.

I have the honour to be

Your obedient humble servant,

(Signed) GEORGE CLERK

Having been requested to superintend the contruction of new models of weights and measures (and very unexpected delays having taken place in their execution), I beg to offer a short Report of the progress which has been made, and of the impediments which have occurred.

On the 16th of August, the making of the models of weight and capacity was confided to Mr. Bate; Mr Troughton, in consequence of his advanced age, having declined the undertaking. Brass being a metal peculiarly liable to injury from the atmosphere of London, I directed Mr. Bate to make experiments on the best combination of tin and copper which might serve as a substitute These experiments occupied the remainder of the month of August.

In the beginning of September I left London, having previously given Mr. Bate ample and detailed instructions respecting every particular necessary for the construction of the models.

On my return, early in October, I learned from Mr. Bate that he had applied to Mr. Donkin the beginning of September, and that Mr. Donkin had then undertaken to turn the models for the bushel; but on the 5th of October, and not before, he informed Mr. Bate that he declined the execution of his engagement. Mr. Bate then proceeded to have models for the bushel cast by the best founders in London; but, most unexpectedly, out of twelve which were cast in various modes, only one proved sufficiently sound to be employed; the metal, on the removal of the exterior crust, appearing full of small holes, of various sizes. The attempt to conquer the difficulties of this part of the work occupied the remainder of October, the whole of November, and the greater part of December In the meantime Mr. Bate proceeded with the other measures of capacity and with the weights; but as these presented no difficulties, his chief attention was directed to perfecting the bushel.

Two troy pounds were made, which I compared, on the 28th of October, with the standard troy pound at Mr. Whittam's, in Abingdon-street. These weights were intended merely as the means of obtaining a near approximation to the avoirdupois pound, and to the weight of a gallon of distilled water.

On the 20th of December, Mr. Bate reported that he had six avoirdupois pounds ready, all the troy weights, and the subdivisions of the troy pound to grains.

It had been my intention to ascertain the capacity of the bushel by measurement, and I had employed myself in constructing the apparatus necessary for that purpose; but as it did not appear probable that the difficulties in casting the bushel would be speedily surmounted, I proposed, at a meeting of the Commissioners on the 21st of December, to determine the capacity of the bushel by the weight of distilled water it should contain, as this, under existing circumstances, would be the more accurate method, and would render unnecessary that nice attention to figure which would otherwise be indispensably requisite.

All difficulty in the construction of the bushel being thus removed, Mr. Bate engaged to deliver to me, on the 1st of February, the following models, viz.—four bushels, four gallons, four quarts, four pints, four troy pounds, one avoirdupois pound, with subdivisions to drams, a two-pounds, a four, a seven, a fourteen, a twenty-eight, and a fifty-six pounds avoirdupois; four weights, each equivalent to the weight of a gallon of distilled water, four to that of a quart of distilled water, and four to that of a pint. These models are intended to serve for constant use at the Exchequer, Guildhall, Edinburgh, and Dublin; the set of avoirdupois weights which will be ready by that time being for the Exchequer. Another set of models, superior in point of workmanship, though not in accuracy, will be afterwards made, and kept as standards to be transmitted to posterity.

I am in daily expectation of receiving from Mr. Bate a set of weights, for the purpose of enabling me to derive the avoirdupois from the troy pound, and thence the weight to be employed in determining the capacity of the gallon.

As no balance exists, either at the Mint or at the Bank of England, capable of weighing upwards of 230 pounds avoirdupois, I have given Mr. Bate the plan of a beam for this purpose, of great simplicity, and which, I trust, will be more accurate than any that has been hitherto made. This beam is also to be finished by the 1st of February.

The standards of linear measure have been prepared by Mr. Dolland, and are now ready for my final adjustment.

The Commissioners will perceive that no further difficulty exists; and should I receive the models from Mr. Bate by the 1st of February, according to his engagement, I trust I shall be able speedily to complete their adjustment, and that they will be ready for delivery in two or three weeks from that period.

HENRY KATER.

York Gate, Regent's Park,
12th Jan. 1825.

To the Commissioners of Weights and Measures.

Whitehall Treasury Chambers,
Feb. 4, 1825.

CALCULATING INTEREST.

SIR,—The Calculation of Interest is an operation of the counting-house of very frequent occurrence, and many people find it very difficult to obtain correct results from modes of calculating sufficiently compendious for common use. I beg leave to take advantage of your valuable publication to communicate a method which I composed for my private practice, which appears to me to possess two valuable properties, viz. perfect correctness in its results, and general application to all possible rates, whether fractional or integral.

I remain, Sir,
Your most obedient servant,
RICHARD DOWDEN.

Cork.

EXAMPLE.

What is the interest of 25*l.* for 219 days at six per cent.?

As 100*l.* for 365 days is to 6*l.* so is 25*l.* for 219 days to 18*s.*

```
100 . . . 365 . . . 6 : : 25 . . . 219
365                       219
-----                     ----
36500                     1095
                          438
                          ----
                          5475
                             6
                          -----
                 36500) 32850
```

In this stage of the calculation the quotient would be the answer in pounds, but we find the divisor greater than the dividend, ∴ the quotient would be zero, indicating that the answer or the amount of interest sought for is less than one pound; we therefore proceed to reduce the dividend into shillings, by multiplying by 20, viz.

```
           32850
              20
           -----
365,000) 6570,00 (18s. Answer.
         2920
          000
```

We have now obtained the true answer, by a divisor containing three digits; but, in common practice, such a divisor would be considered troublesome. Let us, therefore, endeavour to deduce from the above calculation a practical rule, with a divisor containing only two digits.

```
36500 . . . 5475
               6
           -----
           32850
              20
           -----
36500 )   657000
   20         20
-----------------
73,0000 1314,0000 (18s. Answer.
         584
         000
```

We have, above, the product of the sum, × by the days, = 5475 × 6 × 20 × 20 = 13140000; but 6 × 2 × 2 = 6 × 4, and the ciphers being of no value, we have the following theorem, viz.—

Multiply the sum by the days; multiply that product by the rate per cent. quadrupled; cut off two figures, and divide by 73; the quotient will be the answer in shillings.

EXAMPLE.

What is the interest of 25*l.* at six per cent. for 146 days, at five, four, three, &c.?

```
 25 sum           25            3650
146 days         146              16 4 × 4
----             ----          --------
3650             3650          73)584,00(8s.
  24=6 × 4         20=5 × 4       000            3650
------           ------                            12,3 × 4
73)876,00(12s.   73)730,00(10s.                  -------
   146              000                          73)438,00(6s.
   000                                              000
```

DESCRIPTION OF A GUARD FOR THE KEY-HOLE OF A LOCK, INVENTED BY WILLIAM GATENBY, OF RICHMOND, WHITESMITH.

COMMUNICATED BY MR. R. M'VEY.

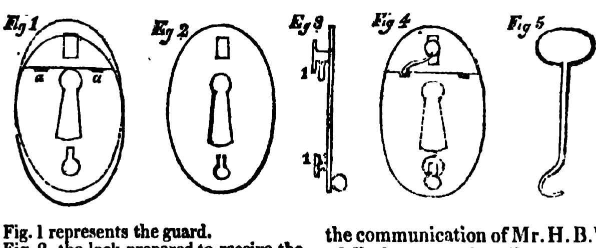


Fig. 1 represents the guard.

Fig. 2, the lock prepared to receive the guard.

Fig. 3, the side section of the guard, showing the knobs, 1 1, to slide in grooves on fig. 2.

Fig. 4 shows the application of a spring under the top-knob, to force it back after it has been pulled down to open.

Fig. 1, *aa*, small hinges, to allow the guard to open.

Fig. 5, the key to introduce into fig. 1 and 2, to pull it down, until the knob, 1, be as low as the circular part of the bottom of the groove, fig. 2.

CEMENTING WATER AND STEAM PIPE JOINTS.

SIR,—I was not a little surprised at reading in your journal of the 26th of February, No. 79, of volume III. the communication of Mr. H. B. Way, of Bath, respecting Roman cement for the joints of water pipes. I very much wish he had given some calculation of the pressure of water on the joints, for I have sometimes used it for patching iron pipes or joints, when I have been in a great hurry, but never found it to stand longer than two or three hours; nay, if exposed to the least jar or shake, which is generally the case in pumping machinery, the cement cracks and falls off the surface. I should be further much obliged to your Correspondent to say whether his pipes are connected with a pump, and if so, of what size it is, and by what driven, by engine or horse-power; as also, whether there are many bends or elbows in the pipes—which pipes are

best, flanged or socket—and whether the pipes have any jar or shake by the velocity of the water passing through them? As I am a practical engineer, Mr. Way will, I hope, excuse my being so troublesome.

Now, Sir, in answer to your Correspondent, "J. T. of Henley-on-Thames, on steam-pipe joints, I embrace the opportunity of informing him what means I have used for many years with success. For what is termed flanged joints, and all such as are not required to be taken apart, I generally use an iron cement made of iron boring, pounded sal ammoniac, and sulphur, in the proportion of forty of borings to one of sal ammoniac and one quarter of sulphur. The exact proportion, however, can only be ascertained from practice. This composition should be wetted with water or urine, and driven into the joint with a hammer and caulking chisel; it will then be found the most durable of all joints, if well made, and will resist steam of any pressure. If the joints are required to be taken asunder frequently, this cement will not, of course, be so convenient, and in such cases a platted rope or gaskin, with some glazier's putty, or white and red lead, will answer every purpose.

I remain, Sir, yours, &c.

√.

Bow, February 28th, 1825.

APPARATUS FOR CLEARING BEER.

Mr. R. W. Dickinson, of the Albany Brewery, Kent-road, has invented a very simple and efficacious apparatus for clearing beer while in a state of fermentation. The brightness of malt liquor depends principally upon the care taken in drawing off the yeast while the beer is working. After the wort has been sufficiently boiled with the proper quantity of hops, it is usually run off into coolers; and when its temperature has been by that means sufficiently lowered, it is transferred to a large vessel called a gyle-tun. In this vessel, after being mixed with yeast, it undergoes the process of fermentation; and before that is complete, is removed into barrels placed side by side on racks, their bung-holes being left open for the yeast, as it rises, to discharge itself, which runs down into a trough placed below to receive it. It is necessary to watch this operation when the beer is in barrels, and to fill up frequently with fresh liquor, to supply the place of that discharged by the fermentation, that the vessel may be always nearly full. The improved method supersedes all this trouble and attention, and the beer works in vessels in which it is stored, supplying itself with fresh liquor in place of the yeast discharged, and always keeping the barrel full.

It is proposed to place all the barrels upright, and having filled them with wort previously boiled, and mixed with the proper quantity of yeast, a pewter pipe, perhaps six or eight inches high, is to be inserted into the bung-hole in the upper end of the barrel, and packed sound, so as not to leak. On the top of each barrel a small tub is to be placed, with a hole in its bottom, through which the pewter pipe is to rise, being securely packed also to prevent leaking, and then into the tub about as much wort is to be poured as will fill up the space in the barrel likely to be emptied by the discharge of yeast. The fermentation going on causes the yeast to rise up the pewter pipe into the tub above, and to supply the vacuity so formed in the barrel below, the fresh liquor in the tub is allowed to run through a small hole in the side of the pewter pipe near its bottom, by which means the barrel is always kept full of beer, and the yeast is received into the tub above.

It is the opinion of Mr. Dickinson, that by the adoption of such an apparatus he saves about one and a half per cent. in quantity, and the beer is by these means greatly improved; he also supersedes the use of a gyle-tun, and saves the expense and loss occasioned by transferring the liquor from one barrel to another.

The Society of Arts have voted to Mr. Dickinson their silver medal for this invention.

IMPROVED CUTLER'S MILL.

Mr Stephen Hoole, formerly from Sheffield, but for many years well known as a celebrated manufacturer of superior engraver's tools in London, has adopted the following excellent improvement upon the Long-wheel, as it is termed, employed by the cutlers in general in town.

Instead of driving his grindstones, &c. immediately from the long-wheel, as usual, he has adopted two intermediate band-wheels, one smaller than the other, but upon the same axis. His long-wheel is six feet diameter, from which a band passes to one of the intermediate band-wheels, of eighteen inches in diameter, and another band from the other intermediate wheel, of four feet in diameter, to the pulley upon the axis of his grindstone, &c.

In this manner he gains as great a velocity in his grindstones, glaze-wheels, &c. as though they were driven by the power of a water-mill or steam-engine; a matter of the highest importance to good workmanship.

His long-wheel has a crank of about sixteen inches radius to turn it by; and the axis of it, as well as those of the intermediate wheels and grindstones, &c. have conical pivots, turning in holes made in blocks of lignumvitæ, and which he finds to be a great improvement over the necks or cylindrical pivots, commonly used for long-wheels; as, before he adopted the conical pivots, it was more than a man well could do to turn his mill; but since then it is driven with great ease.

His long-wheel is loaded close to the rim or periphery with pieces of cast-iron, about three-quarters of a hundred weight in the whole, equally balanced around it, to give it the necessary *momentum*; and a pulley of ten inches in diameter is placed on the intermediate axis, to drive his grindstones slowly when *racing* them, as it is termed.

ON THE "OPTICAL QUESTION."

SIR,—The blundering of a *publishing* mathematician (save the Editor) can have no excuse. I was too much in haste when I wrote my suggestions on the "Optical Question," which you have inserted in No. 76, p. 315, and I am bound to thank Mr. Joseph Hall, in the name of all those of your readers whose deficiency in mathematics might have led them to take the calculation there published as correct, as well as in my own. Mr. Joseph Hall's correction of my error in No. 79, p. 360, is right, and I seem to perceive that he saw I *intended* to be so, and that I knew how to be so; for it is evident, by *his* statement, that 1-264th part of an inch is the "1-33rd part of an eighth of an inch:" the dividing 264 by 8 will plainly show that I meant "33" instead of "32:" and why I made it read "a *compound* fraction" instead of the simple one was, because of the general acceptation of the term, "*one-eighth of an inch.*" And, as for my second blunder, I shall venture to say, Mr. J. H. could plainly see that I had only left the calculation incomplete, by neglecting to multiply by 3, the number of feet (5280) contained in a mile, which would have been, as Mr. J. H. has *rightly stated*, 15840, and for which I humbly declare myself much obliged and properly corrected.

I am, Sir, yours truly,

A MUCH-AMUSED AND CONSTANT READER.

16, Buckingham-street, Portland-road, Feb. 27th, 1825.

IMPROVED GLAZE-WHEELS, OR GLAZERS.

The London cutlers almost generally employ glaze-wheels, made of two thicknesses of solid planks of mahogany glued together, but which are very apt to get out of round, owing to the different natures of the grain of the wood, endways and longways. The best glaze-wheels are made of pieces of alder, so combined that the peripheries of the glaze-wheels are formed of them, with their grain laid endways. Mr. Hoole has one of this description, which was made under the direction of his late father upwards of fifty years since, now in perfect order.

It consists of two pieces of alder, crossing each other at right angles in their centres, and let half-way into each other. The four angular divisions around are filled up with radial pieces, cut out of the wood so as to present their grain endways towards the periphery of the glaze-wheel, and well fitted, jointed, and glued firmly together. This combination is, besides, strengthened by two circular plates of iron, being laid one on each side, and united, by means of screws, with every individual piece of wood composing the glaze-wheel. Square holes are made through these plates for the axis to lodge in, and, when wedged tight upon it, the periphery and sides of the glaze-wheel may be turned truly, which completes it for use.

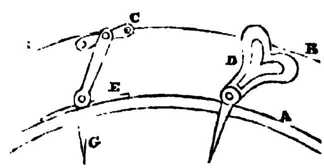
IMPROVEMENT IN DRAWING IRON AND STEEL WIRE.

The acid liquor used in pickling iron-wire during the drawing of it, requiring to be warmed, at an eminent manufactory, ingots of brass, lying at hand, were accordingly heated red-hot and quenched in the liquor; the consequence of this was, that a portion of the copper in the brass became dissolved in the liquor, and was precipitated upon the surface of the iron-wire pickled in it. It was found that the wire thus coated passed through the holes in the plates with remarkable facility, it requiring to be annealed much less frequently than before, owing, no doubt, to the copper preventing the action of the plate upon it, so as to gall or fret it, and, in fact, lubricating it as it were. The head of this manufactory has since constantly availed himself of the use of a weak solution of copper in iron and steel wire drawing. The slight coat of copper is entirely got rid of in the last annealing process.

MODE OF MAKING ITALIAN WIRE-DRAWING PLATES.

A piece of plate-iron is formed into a sort of shallow box or tray, its edges being bent or turned up at right angles all round. This case is then filled with broken pieces of cast iron, and heated to a welding heat, when it is well hammered and firmly united to the iron. The holes are then punched through it from the back, the face of it being thus formed in the cast iron.

IMPROVED BELL-CRANK



SIR,—Having an order some time ago to hang a Bell, that required twelve Cranks to convey the wire round a circular wall, as represented in the prefixed sketch, I found each crank corresponding with that marked DB, to act very ill, owing particularly to its having to lift before it could pull It struck me that I could introduce an improvement; I therefore made a model of a new crank, of the shape described CE, and had several cast from it, and put up, when I found that they performed extremely well. Indeed, they can be used either internally or externally, by making use of a proper pillar, or adding a longer shank to the cranks.

I am, Sir, yours, &c.
A COUNTRY SMITH.

Description of the Drawing.

A the supposed wall.

BB the wire.

C a piece to act on a rivet as the wire pulls.

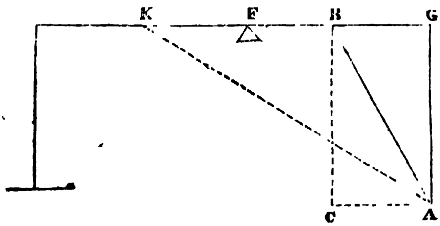
EG the shank or plate to fix the crank.

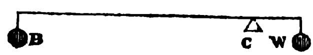
SHOE-LAST-MAKING MACHINE.

The Quebec Gazette informs us that "a very ingenious machine for making Shoe-lasts has lately been made by Mr. Byrne, of the Settlement of St. Patrick on the River

Jacques Cartier. The machine moves on the principle of the common turning lathe, in the present instance by horse power; and what it is remarkable for, is its simplicity, its extensive application, and its forming the shoe-last complete, which the reader knows is of a very irregular shape after the common process of turning."

THE BALANCE QUESTION.





SIR,—It is a well-known essential property of all levers, that the momentum, or moving force of the power, is equal to the momentum of the resistance; or, in other words, a weight, W, of one thousand pounds, suspended one foot from the fulcrum or centre of motion, C, will be balanced by a weight, B, of one hundred pounds, suspended ten feet from the centre of motion, C. Now, suppose W moves through one inch, B moves through ten inches, and the product of the weight, multiplied by the space it has passed through, is manifestly equal at each end.

But G. B.'s lever is the reverse of this: he says, when the man " presses with a force of thirty pounds midway between the pivot and the point of suspension, he throws thirty pounds additional weight on the scale, whilst his pressure upwards will produce a force of fifteen pounds only, on account of the leverage." Now, when the scale and one end of the beam begin to descend, the point which sustains least pressure (according to G. B.) moves through least space, which, if it were a lever, would be impossible.

I need not stop to remind your mechanical friends, that any force exerted in the direction AB, the intensity of which force is measurable by the line AB, is resolvable into the forces, BC, pressing in the direction BC, and endeavouring to separate the points A and G, and CA pressing in the direction CA, which last pressure swings the scale, A, out of the perpendicular, and holds it there as long as the pressure is continued; and this, they will readily perceive, is equivalent to removing the point of suspension of that scale farther from F. Any pressure in the direction AK will have a similar effect. The pressure, then, does not increase the weight, but only alters the position of it; but to those less used to these matters I will endeavour to make it still clearer.

It will be very readily acknowledged, that when a man presses upwards, the ground, or whatever else he stands on, has to sustain his weight, and the pressure caused by the force he exerts, and the point against which he presses upwards has to sustain the pressure caused by his exertion only; it is plain, then, when either the ground or the point above yields to the force the man exerts, they are separated, and move in opposite directions; but G B. makes the scale on which the man stands descend by his pressure, and, by some unaccountable means, the scale beam, against which the upward pressure is exerted, follows in the same direction.

It is evident, therefore, that any extending force acting between the points A and B, in the direction AB, endeavours to separate the points A and B, and consequently to destroy or overcome any force acting in the opposite direction; and,

upon a little consideration, it will be equally evident, that this is *all* which the force acting in the direction AB has the power of doing; and while this is effectually resisted, that is, while the points A and B are kept in the same position in which they were before the force AB was brought into action, no alteration can be caused in the equilibrium of the scales by the action of the force AB.

Will your intelligent Correspondent J. Y. oblige "our practical men," by helping them over the "stumbling-block" he mentions in page 308.

I am, Sir, yours, respectfully,
S. Y. (a young Engineer.)

MEASURING ROUND TIMBER.

Sir,—I beg to submit the following remarks on Measurage's reply, in your Magazine, Number 47, to my letter on Timber measuring in a former Number. After calculating the contents of an elliptical tree, he says—"This sufficiently proves the error of T. M.'s assertion, that a small variation from the figure of a circle would be nearly equal to half the excess of the cylindrical measure above the customary." I asserted, that a small variation of any figure from that of a circle would cause the contents to be less, although the circumference be the same; but I observed that trees in general were far from being round. Surely it must be understood, that by the variation of trees from being truly circular, was not meant a small one. Another thing I mentioned was, that hollow parts are frequently found on the surface of trees (which, I repeat, are very frequent). This Measurage has taken no notice of. I then said, "*these two*, in a quantity of timber of different shapes, *may be* nearly equal to half the excess." This supposition is very different from asserting, as Measurage says I did, that a small variation from the figure of a circle would be so. Let the reader, if he pleases, turn to my letter, and judge if what Measurage has said as above is right or wrong. His elliptical tree contains only one foot eight inches less than the circular tree of the same length and girth first specified by him. I beg to say there is no tree truly elliptical, but there are many in a hundred more unequal in their dimensions than the one he mentions, and, from their irregular form, their real contents are much less than he has stated. Trees (of which I know there are some) approaching to a triangular shape will contain much less in proportion to their circumference than those nearly elliptical. By finding the contents of a supposed triangular tree, the contents of one approaching to a triangular shape may be found nearly. Suppose a tree in the shape of an equilateral triangle, whose side is 16 inches, the circumference 48, at 40 feet long, the customary girth measure is 40 feet, while the true contents are only 30 feet 9 inches, which is 9 feet 3 inches less than the customary measure makes it. The supposed circular tree, of 40 feet long and 48 inches circumference, contains 10 feet 11 inches more than the customary measure makes it. Now, if the half of these two differences be added to the true contents of the triangular tree, or deducted from the true contents of the circular tree, the remainder, or sum, which is the same, may be supposed to be the true contents of a tree approaching as near in shape to a triangle as to a circle, and will be found to be 40 feet 10 inches. Here almost all the excess of cylindrical measure, above customary, is gone.

Measurage calls the variation of his ellipsis from a circle a great one, but the above appears to be a much greater. The ellipsis being a regular curvilineal figure, does not greatly vary from a circle, but contains more within its circumference than any other figure of the same proportion; and if there is no great difference in its diameter more than any other figure, except the circle or regular polygon. Nearly one-sixth of the excess is gone in the elliptical tree, while it appears there is more than nine-tenths of it gone in a tree approaching as near in shape to a triangle as to a circle. In a tree, the right section of which is as near to a parallelogram as to a circle, one-half of it will be gone in a tree nearest the circle, perhaps one-eighth. Now, taking a number of trees of different irregular forms, of which there is not one truly elliptical or circular, nor many nearly so, and also taking the hollows into the account, which Measurage has not done, I will leave the reader to judge if the average loss may not be nearly equal to half the excess of cylindrical measure over customary.

Measurage says, he endeavoured to show the fallacy of the common method in such a manner that the most illiterate mechanic might understand it, and not continue to make use of one so very erroneous without knowing it to be so. The most illiterate mechanic could have understood nothing else from the contents of a tree given by Measurage, and from the diagram accompanying it, but that all trees were correctly circular. Now, Measurage has admitted, with regard to the elliptical tree and to one *nearly* cylindrical, that they are not so, and, consequently, he must admit that the most illiterate mechanic, by following his rule, would be led into a method in every instance erroneous, and I will venture to assert, in some, very much so.

Measurage speaks, too, of calculating the weight of trees from their measure, and asks, how is it possible to calculate the weight with any exactness, if measurers have not a correct method of ascertaining the quantity? If Measurage will set the hewers to hew off my errors, and reduce the tree to an octangular or some other regular form, he then may come at the actual quantity left in it, and calculate the weight by having a correct method to ascertain the quantity; but, as to a tree in its natural shape, he has shown no method to calculate with any exactness either the one or the other. Witness his tree 18 feet long and 148 inches in circumference, *nearly* cylindrical, and containing 190 feet *nearly;* it may be within six feet, or within three, he is not quite certain. Admit the tree to be (as many are) very far from being cylindrical, then its contents would be very far from what is above specified—how far is not quite certain. I have followed the dimensions and contents of the above tree as they are stated, but I beg leave to say there is a mistake in one or the other. A cylinder 18 feet long, and 148 inches in circumference, contains within two inches of 218 feet.

From Measurage's last description of trees compared with his first, it would almost seem that a country mechanic had told or reminded him of something he did not know or think of before, if his judgment as a timber-measurer did not alter the case. I do not doubt his abilities, but I know not how to reconcile his assertion respecting a tree 40 feet long and 48 inches in circumference with his practical knowledge of timber. If what is used as timber, and what is only fit for the fire, has nothing to do with finding the total quantity of timber in a tree, it certainly ought to be of some consideration between the buyer and the seller. It is also clear that, notwithstanding the particular purpose for which any tree may be measured, the general purpose of timber-measuring is to ascertain as nearly as possible the quantity to be sold and bought: and any new method of measuring, when understood and approved, would become that of the buyer and seller. I never asserted that the customary method is correct; I know it is not so; but I am quite as certain that the cylindrical method first attempted by Measurage would be incorrect in every tree, and in many trees more erroneous than the customary. No particular tree, be it of the most irregular growth, or that nearest in form to a cylinder, can be a criterion for ascertaining the quantity of timber contained in a number of trees of different forms, nor do I know of any correct method of doing it.

To conclude, as Measurage tells me, in French, that he is a young man, I beg to inform him, in English, that I am an old one; and if he can find a new system of timber-measuring which shall be approved by all parties in preference to the old, I hope he will enjoy the credit of it; but it must not be that of measuring timber trees as cylinders. I now bid him and the subject farewell.

I am, Sir,

Your obedient servant,

R...., Nov. 1824. T. H.

PLATING WOOD.

The Parisians have introduced an entirely new mode of polishing, which is called plaquey, and is to wood precisely what plating is to metal. Water may be spilled on it without staining, and it will resist scratching in the same degree with marble. The receipt for making it is as follows:—

To one pint of spirits of wine add half an ounce of gum shellac, half an ounce of gum lac, half an ounce of gum sandric; placing it over a gentle heat, frequently agitating it until the gums are dissolved, when it is fit for use. Make a roller of list, put a little of the polish upon it, and cover that with a soft linen rag, which must be slightly touched with cold-drawn linseed oil. Rub them in the wood in a circular direction, not covering too large a space at a time, till the pores of the wood are sufficiently filled up. After this rub in the same manner spirits of wine, with a small portion of the polish added to it, and a most brilliant polish will be produced. If the outside has been previously polished with wax, it will be necessary to clean it off with glass paper.

PRECIPITATION OF SOLID COPPER.

Generally, copper, when precipitated from any solution, is in the state of a very fine powder, without any sort of aggregation. But M. Clement has lately informed the editors of the "Annales de Chimie et Physique," that in a manufactory of vinegar from wood, near Paris, in which sulphate of copper is used in solution, the copper is frequently deposited from this solution in a

state of aggregation. M. Clement possesses specimens which weigh more than 75 grammes. On the part where they have been deposited they assume the appearance of the wood against which they lay, but on the exterior part they have a crystallized appearance. When filed, they are very brilliant, like copper which has been melted, and their specific gravity is not less than such copper.

HINT TO WORKING GOLDSMITHS.

Sir,—Observing in your valuable Magazine descriptions of two machines, one to enable shoemakers, and the other to enable tailors, to do their work standing, I am induced to suggest a similar contrivance for the convenience of goldsmiths. Being one of the latter trade, I know the injurious effects of sitting all day, and am therefore doubly anxious to remove them. Generally speaking, we find mechanics pale and meagre in countenance; and this we may reasonably ascribe to their being confined in unwholesome workshops, amidst charcoal fumes, the smoke of lamps, &c. All this is unavoidable, but sitting is not; from which pernicious custom, weak knees, weak loins, round shoulders, crooked legs, contraction of the chest, and difficulty of breathing, all originate, proving the death of some, and the misery of but too many.

Shoemakers—indeed, every mechanic—ought to be obliged to the inventor of the Shoemaker's Standing Machine. In the course of twenty or thirty years, if this standing plan is followed, we may expect to see shoemakers and other mechanics, who pursue their occupations within doors, become fine, well-grown, able, and hearty men, fit for soldiers and sailors, which now a-days every one knows they are far from being.

I propose, for goldsmiths, to do away with stools altogether, and to use, instead of them, one, two, three, or more moveable steps. Some jobs require the workman to be more elevated, and in this way he may accommodate himself. The boards, of course, would require to be raised much higher than they are now—to the height, perhaps, of the highest man. It is easy to see that this improvement would be attended with little expense or trouble. For the first week or so the workman would feel awkward, and grow much sooner tired; but after a little while, I think he would feel no more inclination to sit than (as has been before observed in your Magazine) a blacksmith or a carpenter.

A Goldsmith's Apprentice.

STEAM-ENGINE WITHOUT BOILER.

The Newport (United States) Mercury states, that an experiment has just been made in crossing Bristol Ferry with a Steam Engine without a boiler, invented by Mr. John Badcock. The experiment was completely successful. The following is the description of the Engine :—

"The substitute for a boiler of a ten-horse power engine consists of two sections of cast iron tubes, one inch thick, each 16 feet in length, in lengths of $3\frac{1}{2}$ feet, and averaging $1\frac{3}{4}$ inch bore, and containing about 3 gallons, placed horizontally in a small furnace, $3\frac{1}{2}$ by $4\frac{1}{2}$ feet and 3 feet high. The end of one tube enters into the top of a cylinder $6\frac{1}{4}$ inches in diameter; the end of the other enters into the bottom; the other ends go out on opposite sides of the furnace, and to each is attached a small forcing pump, one inch in diameter, and they are alternately worked by gearing attached to the cross head. The cylinder is also enclosed in the furnace, and the length of the stroke of the piston is 2 feet 2 inches. The motion is communicated by shackle bars in the usual way, and there is no variation from the common construction of a high-pressure engine. To set it in motion, a fire is made in the furnace with a few sticks of small wood, or half a bushel of coal, and when the tubes are heated, only three cubic inches of water are injected from the forcing pump upon the hot iron, and it is instantly converted into steam; a valve at the same time being open into the cylinder, it forces down the piston;

the other pump then forces the same quantity into the tube; another valve is opened, and the piston ascends; and it continues to operate with unabated vigour as long as it is supplied with water. The number of strokes made by the piston in a minute is about 40, while propelling the boat; and the quantity of water then used is only a gallon in four minutes. It is necessary that it should be fresh water, as the tubes are so small that they get clogged by either salt or sediment; but this is no objection, as by adding a condenser, nearly the whole can be retained, and we believe it will be found to combine the four requisites, cheapness, simplicity, strength, and utility, of a perfect machine. The whole space occupied by it does not exceed that of a small tea-table; and the power may be indefinitely enlarged without much increasing the size, and with few alterations it can be easily adapted to any engine now in use."

THE QUESTION IN SCIENCE.

SIR,—I feel obliged by the answers of J. G. p. 379, but cannot think they afford the information the questions solicit. I am ignorant how change of density lessens weight, as the particles of the air must, under compression, be in contact; of course, the quantity of matter, however different the size of the particles may be one time and another, must always be the same in a given space. I am at a loss also to conceive how temperature lessens weight, or how the same quantity of matter, were it ever in agitation, could be attracted by the earth with less force for being hot. In fact, the momentum of a falling body would be nothing less, were the body absolutely red hot. Again, " new properties arising among elements by intermixture," whence come they? or, can one particle part with, or even communicate, any portion of its properties to another? I believe not. Sir Isaac Newton says, matter is unalterable, otherwise the elements would become worn out and nature changed. He says, likewise, that matter possesses inertia; of what use then would properties be without ability to make any use of them? Perhaps J. G. will be kind enough to show wherein these mistakes lie.

C. D. Y.

WHY ARE WE WARMEST WHEN ASLEEP?

SIR,—Notwithstanding I have been in the habit of sleeping every night and waking every morning all my life, it has but lately occurred to me that I must be vastly warmer when asleep than awake. I am aware how useless it is to send any communication to your popular Magazine that is not somewhat scientific; but I presume the subject of my inquiry is at least as much so as the Raw and Boiled Egg proposition, p. 374; of which, one way or another, (when Mr. Dixon generously furnishes his illustration), I hope to make a rational meal. Give me leave, then, Sir, to ask, whether there is any thing but what is natural, or being natural, that does not take place according to the laws of nature, from which alone we derive our principles of science? Is not that most agreeable knife-and-fork exercise, which is practised daily between whiles, performed on the principle of the lever; and that of tenanting and untenanting the bowels, as Sancho phrases it, promoted by the human frame being a galvanic system in itself? May not, in like manner, sleep be a galvanic operation of some kind? Still, however, I cannot account for sleep being so productive of heat as it is. Every one knows that it becomes less after waking, and that without any change in covering, curtains, or the like. Will some of your learned correspondents be kind enough to solve the problem?

CALORIC.

CASHMERE SHAWLS.

Most of these articles are exported from Cashmere in an unwashed state, and fresh from the looms. Sixteen thousand looms are supposed to be in constant motion there, each of them giving employment to three

men, whose wages are about three pice a-day. It is calculated that eighty thousand shawls are disposed of annually. The wool from Thibet and Tartary is the best, because the goat which produces it thrives better there: twenty-four pounds weight of it sells at Cashmere, if the best sort, for twenty rupees; an inferior or harsher kind may be produced for half the money. The wool is spun by women, and afterwards coloured. When the shawl is made, it is carried to the custom-house and stamped, and a duty paid agreeable to its texture—one-fifth of the value. The persons employed sit on a bench at the frame, sometimes four people at each frame; but if the shawl is a plain one, only two. A fine shawl, with a pattern all over it, takes nearly a year in making. The borders are worked with wooden needles, having a separate needle for each colour. There is a head-man who superintends and describes the pattern. The rough side of the shawl is uppermost while manufacturing.

ROOFING PUBLIC ROADS.

A writer in the Kentucky Argus recommends that public roads should be covered with roofs from town to town, similar to rope-walks. He says, "it will be necessary to use cedar or locust posts, or stone pillars, every fifteen to twenty feet on each side of the road; on these put your plates and rafters, and cover the roof with good oak or ash boards (shingles) about three feet long, well nailed on." By thus keeping the road perfectly dry, the writer thinks it would last a long time. "The advantages and comforts of such a road," he adds, "would be unequalled upon earth. The traveller, in winter, could pursue his journey upon a smooth, dry, firm, summer's road, and would be perfectly secure without the encumbrance or expense of leggins or an umbrella; in summer he would be protected from the scorching rays of the sun, and the drenching showers of rain; he would also be relieved, in a great measure, from the suffocation of the dust, which is produced by cutting up the roads while wet, and pulverizing the clods when dry." It is supposed that a roof would, with little repair, last upwards of twenty years, and, for that length of time, save all labour on the road.

AMERICAN DOMESTIC SPINNER.

A new domestic machine for Spinning Wool, Cotton, Flax, &c. has been introduced into the United States, of which a Correspondent at New York speaks thus highly:—

"The advantages of this machine are such as must recommend it to every one who examines it. Besides a great improvement in the finish and texture of cloth manufactured from yarn made by this machine, it will, in spinning 100 lbs. of common, or 50 or 60 pounds of fine wool, clear itself; for it is calculated that a run and a half can be spun in a day by an ordinary spinner on each spindle; and as there are 10 spindles attached to the machine, it would make 15 run a day, or 90 runs in a week—so that there would be a difference in favour of this machine of 78 runs a week over the common method of spinning. It would thus require but a fortnight or three weeks to clear the first cost of the machine; and any person can easily calculate what an immense saving of time and labour there would be in the spinning of great quantities of wool, cotton, flax, &c.

"The peculiarity in the manner of operation of this machine consists in its having a large pulley substituted in the room of a common spinning-wheel (as in Brown's), which pulley is belted to a small pulley at the bottom, and the speed is increased by a larger pulley on the same shaft, that is belted to the whirl which carries the ten spindles. In this machine the rolls are placed on an apron, and a small roller keeps the rolls from falling (in case the thread breaks) when the jaws or gripe are open, like that of the common billey; but in Brown's the rolls fall to the floor when the threads break; and a ratchet causes the apron to turn when the carriage is sliding down, till the guage strikes a projecting piece of iron, and the jaws or gripe are instantly closed by small levers at each side, to which are attached small weights by a cord passing over rollers, which keep the jaws closed perfectly tight. The guage can be easily altered by any one, so as to let out more or less of the roll, as according to the judgment of the spinner it may require. The thread is also guided on to the spindles in a different way: instead of having to reach up as high as a

person can to lay hold of a handle, the lever is within convenient reach of the smallest person, who is to bear it down slightly. By lifting this same lever up, the jaws or gripe are thrown open, and the rachet is thrown into gear. A creel is also placed at the bottom for doubling and twisting carpeting or stocking yarn. Any person can be taught how to spin with this machine in an hour or two, so as to need no further instruction. The price of the machine, including the apparatus for doubling and twisting yarn, is only 30 dollars."

PYROLIGNEOUS ACID.

Two specimens of meat were, some time ago, exhibited at a Meeting of the Philosophical Society, Whitehaven, which had been prepared with Pyroligneous Acid on the 7th of September, 1819. One of the pieces had been taken to the West Indies to try the effect of the climate, and the other was hung up at home. After the lapse of fifteen months (i. e. January, 1821) they were tasted by all the Members of the Society, and found to be perfectly sweet, fresh, and fit for use.

A Mr. Houston, of New York, with the view of satisfying himself on the subject, caused six pieces of beef usually selected for smoking, and weighing about fifteen pounds each, to be cured with salt, saltpetre, and sugar, in the ordinary way; and when they had been about four weeks in the pickle, they were taken out and hung up for twenty-four hours, after which they were moistened by a brush with nearly a quart of the acid. In a few days they had all the appearance of smoked beef, and when cut in slices, no difference whatever could be discovered between them in flavour or taste. Some hams and tongues, prepared in the same manner, showed a similar result.

"In point of economy," says Mr. Houston, "the difference in the two modes is very striking. The expense of smoking a hundred weight of meat is 37½ cents; the cost of the acid for the same quantity is only six cents. But what is of still greater importance is, that when meat returns from the smoke-house, it generally weighs about a third less than went sent thither. Prepared with the acid, no diminution in the weight takes place; while the juices of the beef and hams which are dried up by the fire of the smoke-house are entirely preserved in the new process. Add to this, that in using the acid there is no danger of the meat being changed, or of its passing through the hands of persons who may not be altogether attentive to cleanliness—considerations which are of no small importance to those who are careful in regulating their household affairs."

INQUIRIES.

NO. 108.—PRODUCTS OF COAL TAR.

SIR,—Joining heartily in the wish that your valuable Magazine may be (as your Correspondent Niloc Esor expresses it) "useful in bringing to light many valuable secrets, which are at present in the hands of a few mercenary individuals," I take advantage of it to beg any of your Correspondents will answer the following questions:—

What is the preparation from coal tar which is called petroleum?—and whether it be the same article called coal oil, spirits of tar, and essential oil of tar?—for by all those names I have heard it named.

Whether it be not the same fluid which has been used for lamps?

And, lastly, where this spirit of essential oil of coal tar can be procured?

I am, Sir,
Your obedient servant,
T. RETRAP.

NO. 109.—CUTTING SCREWS.

SIR,—I should feel extremely obliged to any of your Correspondents to solve the following difficulty:

Having a Screw to cut, about a foot long in the thread, I have found, after repeated trials, that both the top and bottom ends are by much the largest. Now, as I have no regulator or machinery for cutting screws but the common stocks and

dies, such as smiths use, I should be glad to know the reason why the middle is smaller than the ends?—and if any method can be used to make the screw the same size the whole length, as that is desirable for the object wanted?

A JUVENILE READER.

Woolwich.

NEW PATENTS.

To Edward Lees, of Little Thurrock, Essex; and George Harrison, brick-maker, of the same place; for a new and improved method of making bricks, tiles, and other articles manufactured with brick-earth Dated February 1.—To be specified in six months.

To John Thin, of Edinburgh, architect; for a new method of constructing a roasting-jack. Dated February 1.—In two months.

To Samuel Crosley, of Cottage-lane, City-road, Middlesex, gent.; for a certain apparatus for measuring and registering the quantity of liquids passing from one place to another. Dated February 1.—In six months.

To Samuel Crosley, of Cottage-lane, City-road, gent.; for improvements in the construction of gas-regulators or governors. Dated February 1.—In six months.

To John Heathcoat, of Tiverton, Devon, lace-manufacturer; for certain improvements on the method or methods of manufacturing silk. Dated February 1.—In six months.

To Timothy Burstall, of Bankside, Southwark; and John Hill, of Greenwich, engineers; for a locomotive or steam carriage, for the conveyance of mails, passengers, and goods. Dated February 3.—In six months.

To George Augustus Lamo, of Rye, D. D.; for a new composition of malt and hops. Dated February 10.—In six months

To Richard Badnall, the younger, of Leek, silk-manufacturer; for certain improvements in the winding, doubling, spinning, throwing, or twisting of silk, wool, cotton, or other fibrous substances. Dated February 10.—In six months.

To Edward Lees, of Little Thurrock, Essex, publican; for certain improvements in water-works, and in the mode of conveying water, for the purpose of flooding and draining lands; which said improvements are also applicable to various other useful purposes. Dated February 19.—In six months.

To Thomas Masterman, of the Dolphin brewery, Radcliffe, Middlesex; for an apparatus for bottling wine, beer, and other liquors, with increased economy and dispatch. Dated February 19.—In two months.

To Edmund Lloyd, of North End, Fulham; for a new apparatus from which to feed fires with coals and other fuel. Dated February 19.—In two months.

To Benjamin Farrow, of Great Tower-street, London, ironmonger; for an improvement or improvements in buildings, calculated to render them less likely to be destroyed or injured by fire than heretofore. Dated February 19.—In six months.

To Jesse Ross, of Leicester, hosier; for a new apparatus for combing and straightening wool, cotton, and other fibrous substances. Dated February 19.—In six months.

To Jacob Mould, of Lincoln's Inn-fields, Middlesex, Gent.; who, in consequence of communications made to him by a certain foreigner residing abroad, is in possession of certain improvements in fire-arms. Dated February 19.—In six months.

To Henry Burnett, of Arundel, Sussex, Gent.; who, in consequence of communications made to him by persons residing abroad, is in possession of certain improvements in machinery, for a new rotatory or endless-lever action. Dated February 19.—In six months.

CORRESPONDENCE.

E. J.'s communication and model we are unable to comprehend. Its object requires some elucidation.

Snug's last communication is intended for insertion.

How long will the paper of Amicus be? Our decision as to its insertion will depend much on that circumstance.

S. L. D.—They are not yet awarded.

Communications received from—Mr. Combes—Mr. Pasley—A Subscriber—Mr. Andrews—S. Cooper—Plumbago—H. Bloxam—D. F. G.—T. B.—Mr. James White—T. W. S.—Square—An Experimentalist.

ERRATUM.—In the answer of Telloc Trigger to the first question on Gunnery, p. 383, Number 81, for 3-8ths, read 5-8ths bore.

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

Printed by B. BENSLEY, Bolt-court, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

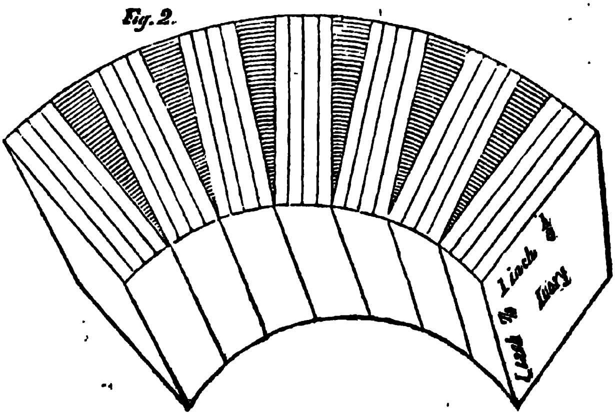
No. 82.] SATURDAY, MARCH 19, 1825. [Price 3d.

"Until the present epoch the Sciences have been the patrimony of a few; but they are already become common, and the moment approaches in which their elements, their principles, and their most simple practice, will become really popular. Then it will be seen how truly universal their utility will be in their application to the Arts, and their influence on the general rectitude of the Mind."—*Condorcet.*

IVORY PROFILE PORTRAITS.

Fig. 1.

Fig. 2.



IVORY PROFILE PORTRAITS.

SIR,—I am not enough acquainted with the ivory toy-trade to know whether "*fish* and *counters*," such as are used by card-players, are enough in request to make the following suggestion of any advantage. Ivory *profile portraits* can be made, as counters, &c. if the artist is a good turner, or a good turner an artist. Thirty years ago I was enough of both to have made them; but being well employed in painting, and finding some considerable capital necessary to such a novel undertaking, I proceeded no farther than *one experimental proof*, and thus the invention has rested with me. I understand that a complete set of counters or fish is *nine dozen*, and I calculate that 100 *portraits* (each a complete and interesting substitute for a fish or counter) might be turned out of one block; so that 108 *different profile likenesses*, 100 of each, would *be completely produced* by turning 108 blocks, that would be 100 sets of counters, &c. The preparation of the blocks would be no difficult work, but I am incapable of giving a true estimate of the expense of the ivory. Each piece of ivory would be about the size of the first of the preceding figures, 100 of which will be glued up in each block, being first smoothed on both surfaces, as finished; and when the block is finished turning, the 100 profile counters of one person is complete, only by soaking it till the ivory will separate. Thus 100 times 108 portraits of the most distinguished persons might be had as two sets of counters, or a set might be formed altogether on a coloured ground; and on any singular event, the *hero* of such might be published in this form within two or three days after the drawing is obtained.

The second of the preceding figures exhibits a section of a quarter of a block, showing how the ivory, four pieces together, are to be distributed round the circle. The intermediate pieces, of the wedge form, must be hard, close wood.

I am, Sir,
Your obedient servant,
O. O.

P.S. Should any principal be disposed to take my further explanation, you are at liberty to give him my address.

PRESSURE OF THE OCEAN.

SIR,—In your 80th Number a Correspondent requests to be furnished with some facts respecting the Pressure of the Ocean on Bottles submitted to its influence. I beg leave to refer him to the Imperial Magazine, for December, 1819, where he will find this subject treated of at length, and illustrated by a variety of experiments, which, I make no doubt, he will find conclusive. The paper is highly interesting, and were I not fearful of trespassing too much on your kindness, I would gladly transcribe the whole. As, however, some of your readers may not have an opportunity of obtaining it, a general outline may not prove unacceptable.

The experiments first detailed were made by the Rev. John Campbell and a friend of the writer, with a common bottle, corked and sealed. The results appear to be of two kinds: first, where the cork was forced into the bottle, and, secondly, where it appeared to be unmoved. With respect to the first, no difficulty will occur in accounting for the effect produced, as it is manifestly owing to the great pressure of water at 100 fathoms depth; but, for the second, it is rather more difficult to account, especially as it is stated that, in both cases, the bottle filled instantaneously. The Rev. John Campbell refers it to the "porousness of the glass;" but to this opinion many forcible objections might be urged, the principal of which seems to be the *sudden* rushing in of the water, which is described as instantaneous. But before the water could fill the bottle, the air must be allowed to escape; "and for this," the writer observes, "nothing short of hours, or days, or weeks, could be calculated upon, instead of any thing like a period that could be denominated sudden or instantaneous."

The only method, therefore, which appeared of setting the question at rest, was to try the experiment with

a vessel wholly formed of glass; for this purpose, another friend of the writer, proceeding to Ceylon, was provided with two bottles, one hermetically sealed, and the other having a ground glass stopper; the result of his experiments is likewise communicated. The bottles were lowered to the depth of 100 fathoms, and came up quite empty; but, on a second trial, the one hermetically sealed appeared to have a flaw in it, and it was, in consequence, *three-fourths* full of water, which escaped on its being drawn up. This fact, however, will furnish an argument rather for than against the general conclusion to be drawn. If the effect, as at first conjectured, were dependent on the porosity of the glass, the bottle would have been completely, instead of partially filled. The one provided with the glass stopper came up empty, as before.

The writer in question concludes, therefore, that the water gained admission through the pores of the cork and sealing-wax, not of the glass. With this opinion I apprehend the generality of your readers will feel disposed to coincide; "although," as he observes, "the case is still attended with singular phenomena."

I shall make no apology for the length of this communication, having abridged the article more than it deserves. The subject is certainly interesting, and did my leisure permit, I would gladly have bestowed on it that attention which it merits.

I am, Sir,
Your obedient servant,
N. R.

SIR,—"A Constant Reader" requests a description of circumstances relative "to the corked bottle sunk in the ocean," page 382; and being desirous of affording my limited information, I willingly convey the result of my experiments, indulged (rather as pastime) in ploughing the deep.

I have taken the common beer bottle, had it well corked, sealed, and coated, so as to be (as I thought) impervious, and affixed thereto a sounding line, with deep-sea lead attached, so balanced as, in one instance, to regulate the sinking bottom undermost—in the other the neck undermost: the depth they reached might be about 80 fathoms. In pulling them in again the result was the same—both bottles being nearly full of water, and the corks forced out. I have pursued this fancy further, by trying the experiment with bottles hermetically sealed, having no aperture, similar in size to the soda-water bottles, and having the same rotundity of shape at each end. In some instances these bottles broke, in others they were hauled in with a half and even three parts filled with saline particles. The result in my mind was, that the porous quality of glass, thus exposed to pressure, suffered the fixed air to escape, and, from the like cause, admitted grosser particles. You must not expect a more scientific illustration from one who handles a TAR BRUSH.

March 9th, 1825.

SIR,—Having seen, in the Mechanics' Magazine of March 7th, an inquiry of a Correspondent relative to empty bottles being sunk in the sea, and the attendant effects, I have ventured to make a few remarks on the subject, your inserting which will oblige

Your obedient servant,
W. L.

Red Lion-street, March 11th, 1825.

During a voyage to the East Indies, being in a calm on the Line, we amused ourselves by the experiment of lowering a bottle, by means of a weight attached, to the depth of about 60 fathoms. The cork had previously been driven in as tight as possible, and well sealed over with sealing-wax. After it had remained down about three minutes, it was hauled up; the bottle was about half full, the water was quite salt, and the cork and wax as sound as before the bottle was lowered. It was then emptied, corked and sealed up closely again, and lowered to the depth of about 80 fathoms; after remaining about the same time as before, it

was hauled up, and the cork was found to have been forced into the bottle, which quite convinced me that the only possible way the water could have got into the bottle, in the first experiment, must have been through the cork. The superincumbent pressure on the cork must have been very great, for, allowing a column of water, of the diameter of a common cork, and one inch in height, to weigh one ounce and a half at the depth of 60 fathoms, there would be a pressure of more than 400 lbs., and at the depth of 80 fathoms, 540 lbs. Perhaps I may not be correct in my calculations, but I should suppose I am rather under than over the mark.

I have heard one of the officers of the ship in which I was, and on whom I could depend, say that he had varied the experiment by passing a sail-needle through the cork, close to the mouth of the bottle, so that the cork could not be forced in, and when it was drawn up it was found to be full of water.

It has been remarked by some, that the filling of the bottle could be perceived by a sudden and increased weight, as though the water got in instantaneously; but that cannot be, for a weight five times as heavy as a bottle of water can scarcely be felt at a depth of 60 or 80 fathoms. I should imagine the experiment might very easily be tried on shore, by subjecting an empty bottle, well corked, to a pressure equal to the weight of the water pressing on the cork in the above experiments.

A glass globe, without any orifice, has been lowered into the sea, and it came up quite empty.

MORTAR.

Sir,—If a piece of Mortar, taken during the month of November from one of the piers or columns of St. Botolph's Priory, Colchester, built in 1100, will be of any use to your Correspondent who signs himself "A Subscriber," in your Magazine, No. 78, February 19, 1825, I will send it to him on being made acquainted with his address.

It would have been satisfactory to some of your readers if he had put his initials to his letter in the first instance, or is the "Subscriber" the architect alluded to in the letter of Abel Handy, page 328, No. 77, and unwilling to afford any clew by which he may be known?—Is the Church at Chelsea?

I am, Sir, yours, &c.

A Subscriber.

March 7th, 1825.

RECEIPTS FOR LACQUER.

Sir,—I send you two Receipts for Lacquer, which are the result of numerous experiments made by a gentleman who was a pupil of the celebrated Lavoisier. I wish your widely-circulated Magazine to be the means of communicating them to the practical mechanic, who will be the best judge of their real value.

I am, Sir, &c.

L. Lessur.

Pale Tin Plate Lacquer.

Strongest alcohol	4 oz.
Powdered turmeric	2 drachms
Hay Saffron	1 scruple
Dragon's blood, in powder,	2 scruples
Red Saunders	½ scruple

Infuse this mixture in the cold for 48 hours, pour off the clear, and strain the rest, then add

Powdered shellac	½ oz.
Sandrach	1 drachm
Mastic	1 drachm
Canada balsam,	1 drachm

Dissolve this in the cold by frequent agitation, laying the bottle on its side to present a greater surface to the alcohol; when dissolved, add 40 drops of spirits of turpentine.

Deep Gold Lacquer.

Strongest Alcohol	4 oz.
Spanish Annotto	8 grains
Powdered turmeric,	2 drachms
Red Saunders	12 grains

Infuse and add shellac, &c. as to the pale tin lacquer, and, when dissolved, add 30 drops of spirits of turpentine.

N.B. Lacquer should always stand till it is quite fine before it is used.

SQUARE AND CUBE ROOTS.

Sir,—According to promise, I proceed to state my plan, on a fixed foundation, relative to the Square and Cube Roots, whereby any person, having a knowledge of simple multiplication, may calculate his own tables with ease and dispatch.

SQUARE ROOT.

Although it appears that 3 is not the mean proportion exactly between 2 and 4 in square measure, yet the square root proves that twice 2 is 4 complete; hence it follows that any given number of squares, multipled by 4, its product will answer to a double root. For example, I will begin with 64 squares, whose root is 8:—

	64......	Root 8.
	4	
Squares.......	256......	Root 16, double.
	4	
Squares........	1024......	Root 32, double.
	4	
Squares........	4096......	Root 64, double.
	4	
Squares......	16384......	Root 128, double.
	9	
Squares......	147456......	Root 384, threefold.
	100	
Squares......	14745600....	Root 3840, tenfold.

GENERAL RULES.

Any given number of squares, multiplied by

4 will raise the root	2 fold.
9	3
16	4
25	5
36	6
49	7
64	8
81	9
100	10
400	20

&c. &c.

To find the root of 13, 15, 17, or 19, say: For 15 the half is 7½; to the 7 add the decimal fraction of 5-10ths; multiplied by itself will produce the squares for 7½. The fraction will cease when the root is 15.

CUBE ROOT.

As in the square, so in the cube; the only difference is in the number of squares answerable to the roots. Any given number, multiplied by 8, will produce a number of squares whose cube root will be double to the former. By way of example, I will begin with 216, whose root is 6:—

Squares........	216........	Root	6.
	8		
Squares......	1728........	Root	12, double.
	8		
Squares....	13824........	Root	24, double.
	8		
Squares....	110592........	Root	48, double.
	8		
Squares....	884736	Root	96, double.
	1000		
Squares....	884736000 ..	Root	960, tenfold.
	8000		
Squares....	7077888000000..	Root	19200, twentyfold.

GENERAL RULES.

Any given number of squares, multiplied by

8 will raise the root	2 fold.
27	3
64	4
125	5
216	6
343	7
512	8
729	9
1000	10

&c. &c.

While I hope the youth at school will receive a little instruction, I doubt not but your more learned readers will perceive a key that will give a considerable opening to the remaining nine powers.

I am, Sir,
Very respectfully yours, &c.
J. SUMPTER.

No. 3, King-street, Surrey-square,
March 2, 1825.

BRITISH BRANDY.

SIR,—In answer to your Correspondent, "No Chemist," I will tell him that he may make a very potable British Brandy, by flavouring clean, rectified, British proof-spirit with a syrup made of French plums, boiled for some time, with the stones broken, to give it the flavour of the kernel. I could tell him what ingredients some of the distillers use for the same purpose, and I repeat that it is a most "abominable compound;" but I withhold the information, not because I have more feeling for those gentlemen than for the mechanical and operative part of your readers, but because I think that the information would not be useful, or rather, I should say, beneficial to them. Suppose, for instance, that I could tell them how to make counterfeit half-crowns, which would pass for the current coin of the realm, do you think, Sir, that I should be rendering a service to society by showing how it was to be done?

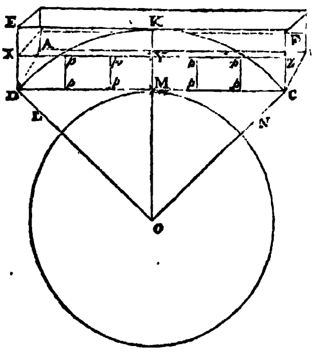
If any one doubts that there are such persons as *Distillers' Chemists*, let him look into the Directory; but if these gentlemen sell drugs and chemical preparations to distillers, they cannot be held accountable to the public for the use that may be made of them, any more than a gunsmith is who sells a pistol to a man who afterwards shoots himself or his friend with it. After all, I think the less brandy our operative friends drink, the better, whether French or British; and if they are inclined to

brew, I would recommend them to brew beer. I meant no libel upon the taste of John Bull, when I asserted that French brandy was coloured with burnt sugar to please him; but such is the fact, and I challenge your Correspondent, whether Chemist or "No Chemist," to disprove it.

I remain, Sir,
Your ancient friend,
BIBO.

March 8th, 1825.

APPARENT AND TRUE LEVELS.



A Level Surface is a surface that is equidistant from the centre of the earth; thus, in the figure prefixed, the surface of the globe, LMN, is level, because the distances, LO, MO, NO, are equal; the surface, LMN, is therefore called a *true level*, in distinction from the line DMC, which is called an *apparent line of level*, because the distances, DO, CO, are greater than MO, and yet to the eye it appears strictly level. Now, in making a canal of a mile in length, a fall of eight inches is allowed, to *reduce the apparent line of level to the curvature of the earth.* But supposing, in some part of the earth's surface, an aqueduct, EDH, be constructed, whose bottom should be an apparent line of level, as DMC; each half, MD and MC, being (what it would be) a tangent to the earth's surface, and that it be 56 miles in length, with its ends, ED and H, closed up. Fill this aqueduct with water, and, upon the principle that water will find its level, what would the surface be? Would the surface of the water be a true level, as DKC, corresponding to the curvature of the earth's surface, LMN? or would it be an apparent line of level, as XYZ, filling the aqueduct at an even depth all along, from one end to the other, as shown by the perpendiculars, *pp*, on the line DC.

If this inquiry can be satisfactorily answered, several useful inferences might be drawn, which would materially assist the managers of water-mills.

MECHANICAL GEOMETRY—PART III.

Definitions.

1. *Proportion* is, geometrically speaking, considered the relation that one line or magnitude has to another, or one surface or solid to another; and, mechanically, is the comparison of the length of any rod or rule, the superficial contents of any surface, or the solid contents of any body, with another or others of different dimensions: thus, for instance, a rod of three feet is the third part of one of nine feet; and we say the proportion of the two rods is as three to nine. Again, when a plank that contains one superficial foot, is compared with another of four feet, we say that these planks are in proportion to each other as one to four; and, consequently, that the lesser is the proportion of 1-4th to that of the greater; and the same may be said respecting solids.

This *proportion* of quantities, whether lines, surfaces, or solids, is, in the language of geometry, called the *ratio* of quantities.

2. The *measure* or quantity of any ratio is that number in arithmetic, or line, surface, or solid, in geometry which shows the proportion that any two numbers, lines, surfaces, or solids, bear to each other: thus, if any two quantities, represented by the letters A and B, are in the proportion, for instance, of four to twelve, we know that B is three times the dimensions of A; and this number is the *measure* or quantity of the ratio A is to B; that is, A is 1-3d of B; and then we say that the proportion or ratio of A to B is 1-3d.

3. Any three numbers, lines, surfaces, or solids, are said to be in proportion, when the first is to the second in the same proportion as the second is to the third: thus, if A, B,

C, represent any three quantities, their quantities are said to be proportional when A is to B in the same ratio as B is to C, and is usually written thus, A : B : : B : C.

4. Any four numbers, lines, &c. are said to be proportional when the first is to the second in the same proportion as the third is to the fourth: thus, A, B, C, D, are said to be proportional when A is to B in the same ratio as C is to D, and is thus expressed, A : B : : C : D.

5. When three quantities are proportional, the middle quantity, or, as it is commonly expressed, the middle term, is said to be a *mean* proportional to the other two quantities, which are termed the extremes: thus, if A, B, C, are proportional, B is said to be a *mean* proportional to A and C.

6. When four quantities are in proportion, the two middle terms are called the means, and the first and last terms are called the extremes: thus, in the proportion A : B : : C : D, we call B and C the means, and A and D the extremes.

There are two sorts of ratios or proportions; the first *rational*, when the one magnitude is contained any exact number of times in the other with which we are comparing it: thus, the proportion of a line of two feet to that of ten feet is a *rational* proportion, that is, the one is contained in the other exactly five times; the other *irrational*, and is that when the two quantities we compare are not contained any exact number of times in each other: thus, when we compare the diagonal of a square with its side, we find that the side is not contained any exact number of times in the diagonal, for it is somewhat less than three times the half of the side, and somewhat more than five times the fourth part of it; and thus, when we can divide any quantity into any number of equal parts which will measure another quantity exactly, we say that the one quantity is commensurate to, or capable of being measured exactly by, the other; and, on the contrary, when we are unable to divide any quantity into a number of equal parts which shall measure another quantity, we say the quantities are incommensurate with each other, or the one is incapable of being measured exactly by the other.

8. In every right-angled triangle, that side which is opposite the right angle is called the *hypothenuse*, and the other two sides are called the *base* and *perpendicular*.

9. In any other triangle, if we call any side the *base*, the other two sides are called the *legs*.

10. In any triangle, the angle opposite the base is called the *vertex* of the triangle.

11. Any line drawn from the vertex of a triangle, perpendicular to the base, is called the *altitude*, in height, of the triangle; or, if this line falls without the triangle, as is the case when in any obtuse triangle the perpendicular is drawn from either of the acute angles; then, if the base is produced till it meet the line from the vertex, it determines the altitude or height of the triangle.

G. A. S

(*To be continued.*)

MR. JENNINGS'S GAS-BURNER.

Fig. 1.

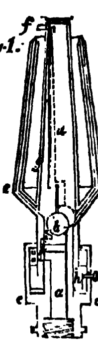


Fig. 2.

Our Correspondent, Mr. H. C. Jennings, has just enrolled a patent for a very ingenious appendage to a Gas-burner, for preventing the improper escape of gas, and the danger and nuisance consequent thereon. It is constructed upon the principle of two dissimilar metals attached together expanding differently under the same temperature, like some of the compensation balances attached to chronometers. The aperture through

which the gas rises from the pipe to the burner is to be closed when the gas is not burning, by a ball resting in a concave socket at the top of the aperture. This ball is suspended by a bent arm from a pin set in the top of the burner, which arm is formed of two dissimilar metals, as two thin strips of brass and steel attached together by sliding joints. The pin supporting the arm being heated, communicates that heat to the two thin strips of metal, which, by curling up as they expand, draw the ball upon one side out of the socket, and thereby open the passage by which the gas proceeds to the burner.

The first of the preceding figures shows a section of the burner with the improvement attached. The gas proceeding from the pipe below rises up the passage, *a*, of the fixed socket, *cc*, and would pass into the burner, but that the ball, *b*, resting in the concave aperture at the top of the socket, closes the passage. In order to permit the gas to pass into the burner for the purpose of lighting it, the upper part of the burner must be raised; this may readily be done, as the lower part of the burner slides in the socket, *cc*. Lifting up the burner, therefore, by the hand, raises the ball, *b*, out of the socket, and the gas passes through the passage *a* into *d*, and up the lateral tubes, *ee*, to the burner.

When the gas round the burner has been on fire about a quarter of a minute, the pin, *f*, which is enveloped in the flame, will have become hot, and this heat having communicated to the bent arm, *g*, that arm will curl up as shown by dots, in consequence of the different expansions of the two dissimilar metals of which it is made. The ball having been thus drawn aside from its seat, the burner may be let down again to its former position, and the gas will continue to flow through the passage as long as the arm remains curled up by the expansion; but when the flame is extinguished, the pin and the bent arm becoming cold, the ball will resume its former situation, and close the passage of the gas, even though the stop-cock had negligently been left open.

The contrivance by which the gas is to be turned on and off, that is to say, the stop-cock, will be best understood by reference to the horizontal section, fig. 2. The outer ring, *cc*, shows the extreme diameter of the socket in which the burner slides up and down, as before said; in the lower cylindrical part of the burner, a recess, *h*, is made, extending one quarter of a circle, with a pin, *i*, passing through the outer rim into the recess, for the purpose of confining the turning of the burner to that distance. In the centre of this horizontal section will be seen the circular passage, *a*, up which the gas rises from the pipe below; on the side of this passage a lateral opening is formed for the gas to proceed into a semicircular recess, *k*, in the lower cylindrical part of the burner. This recess is shown in fig. 2, as turned away from the lateral opening, as it would be when the the stop-cock is closed; but in the vertical section, fig. 1, it will be perceived that the passage is open, the recess, *k*, being there opposite to the lateral opening; and therefore in this position of the aperture the gas is allowed to pass from the lower passage through the recess, *k*, into the upper part of the burner.

By the contrivance first described, it will be seen that the aperture to the burner becomes closed whenever the light is extinguished, even supposing the stop-cock is left open, and that by these means the great nuisance and danger arising from the flow of the gas when not burning is hereby effectually prevented.

SAFETY FOR THE LIVING.

Miseris succurrere disco.

SIR,—I am astonished that, in an enlightened country like England, the untenanted habitation of life should be more thought of than life itself. The several writers in your Magazine, who interest themselves more about what becomes of a stinking carcase than a living soul, cannot think, with Homer, that

> The sage physician, skill'd our wounds to heal,
> Is more than armies to the public weal;

else they would not employ their ingenuity in finding means to check that science which a few years ago was in her high career—Witness the bills of mortality. I will venture to say, that no one who concerns himself so much about the destruction of those necessary villains, called resurrection men, has ever had the misfortune to meet with such a severe accident as to require the utmost skill to preserve his life. He has never submitted to an operation where the deviation of the knife a line to the right or left, must inevitably change the reasoning, godlike form of man into a lump of corruption.

The person who styled himself "A Medical Reader," in Number 69, did not sign his name: he was right, for he is no surgeon, I am sure. In Number 72, a "Lover of Justice" shows that he has a wise head and a good heart. "Medicus" says, in the same Number, that every medical student ought to dissect two or three bodies before entering on his duty as a surgeon. I do not hesitate to say, that it would be criminal, and show an incorrigible want of principle, in any man who would dare to practise surgery, having done no more than this

in the way of anatomy. To such a man we soon might say—*Surge tandem, carnifex!* I hold it impossible to learn anatomy without dissecting at least six subjects, and just as impossible to become an adroit surgical operator, without cutting up ten or twenty more

In Number 70, T. M. B. asks if no other plan can be adopted by our schools of medicine, whereby they may be supplied, than the present shameful custom which prevails? I suggest one, which would partially (I believe soon entirely) do away with the British prejudice, "that it is better to be dissected by crawling worms than by the disciples of Æsculapius." I believe, that if hospitals were established on such liberal principles, that the patients could be supplied, not only with the common necessaries of life, but also with those little articles of want which are denied them elsewhere, such as tea, sugar, tobacco, snuff, &c. (when disease does not forbid the use of them) we should find plenty of the lower order to fill those hospitals where it was a known rule that the bodies of those who died should be at the surgeon's disposal. There are thousands of our poor who have that philosophy which I have witnessed for years on the Continent (and where I have bought subjects at 2s. 6d. and 3s. 4d. each, as often as I pleased, whilst our professors in England were paying twenty guineas), that leads them to say, "If you take every care of me during my life, you may do what you please with me after my death."

That we have not hospitals enough to receive half of those who are afflicted with the most dreadful maladies, I had but too frequent proofs during my dresserships to Sir Astley Cooper and Mr. Thompson Forster, at Guy's Hospital. It was a most heart-rending scene, every Wednesday, to see the number of sufferers who could not be admitted, but were

"Cast abandon'd on the world's wide stage,"

not only writhing under the lash of extreme poverty, but also that of tormenting disease; doomed "to drink the cup of baleful grief, and eat the bitter bread of misery."

He who says that medical men are not susceptible of sympathy, and

"Never muse on sorrow but their own,"

should know the liberal subscriptions of English medical students to alleviate the temporary sufferings of their fellow-creatures on these occasions.

I have frequently been shocked, in the hospitals of England, at the hypocrisy and inhumanity of those who called themselves the friends of a deceased patient. I have known a poor wretch to be left for weeks without seeing or hearing of these said friends, who might have done much to soothe his biting misery, but who, on being informed of his death, would not hear of his being buried by that charitable institution which found him unpitied and unheard, without a friend, without a home.

As your useful Magazine is now circulated so freely, both among great and small, I trust that you will favour a constant reader by inserting what common sense has dictated; and that some person, whose delight is to do good, and who is more capable than myself of undertaking a cause which I have so much at heart, will step forward and show by what means this plan can be brought into execution, which has for its object the perfection of medical and surgical knowlege—consequently the happiness of mankind. *Dum spiro, spero.*

S. ELCUM,
Member of the London College of Surgeons, and Graduate of the University of France.
No. 116, Blackfriars-road.

BROWN'S GAS ENGINE.

We copy the following impartial observations on the merits of this Engine from the *Scotsman*:—

"A very ingenious paper on this engine appeared lately in a cotemporary paper (the *Caledonian Mercury*), and on Wednesday night Dr. Fyfe made some interesting remarks on the same subject, at the close of his lecture in the School of Arts (of Edinburgh). Before proceeding farther, we may remark, that Mr. Brown's engine has made us acquainted with a fact, which we believe was scarcely known before—the extraordinary rarefaction produced by the sudden combustion of a quantity of gas in a mass of common air. It is upon this, and not upon the condensation of a part of the gaseous fluids, that the power of Mr. Brown's engine chiefly depends; and till the engine itself was exhibited, it was not, we believe, suspected that the momentary effect of the heat evolved in dilating the aerial mass, was one-third part of what it is actually found to be.

"It has been stated in the *Mercury*, that, by mixing 1 part of coal gas with 7 of common air, a vacuum equal nearly to 5 parts was produced, the residuary air occupying three parts of the glass vessel, and this proportion of 1 part of gas to 7 of common air was found to be most advantageous. When oil gas, however, was employed, 1 part of the gas added to 20 of common air was found the most advantageous, and the vacuum formed amounted to 10 parts. In the first set of experiments, therefore, 1 foot of coal gas afforded 10.

"Dr. Fyfe conducted his experiments pretty nearly in the same way, but ar-

rived at results considerably different. He stated that, after many trials, he found that the greatest effect was produced when 1 part of coal gas was mixed with 30 of common air, and that he had sometimes obtained a vacuum equal to 24 parts, though, on account of the nicety of the operations, it was often much less. He repeated the experiment with 1-30th of gas several times in presence of the class, and the vacuum obtained varied from 15 up to 21 parts, the whole contents of the glass being 30. The Doctor considers the vacuum as produced almost entirely by the sudden dilatation of the air; and he has no doubt that, with apparatus properly contrived, a vacuum equal to 24 or 25 parts, that is, to 4-5ths or 5-6ths of the contents of the cylinder, might be constantly obtained. He added, that he has since learned that 1-30th of gas is the quantity actually used by the patentees in London, and that the vacuum produced is nearly what he stated.

"The price of coal gas in Edinburgh is 12s. per 1000 cubic feet in shops. But this price covers the great expense of pipes, the loss from breakage, and the profits of the manufacturer. Dr. Fyfe stated, that the prime cost of the gas was 4s. 11d. per 1000 cubic feet, but that gas sufficiently good for working an engine, extracted from a cheaper coal, and purified by a less expensive process, might be furnished at 2s. 9d., or, taking a round sum, at 3s. Now, assuming that 24 feet of steam per minute afforded a power equal to that of one horse, one foot of gas, yielding 24 of vacuum, should produce the same effect. Hence a pneumatic engine of one-horse power should consume 60 cubic feet per hour, or, in round numbers, 1500 cubic feet per day; the cost of which, at the price mentioned, would be 4s. 6d. It follows, that this expense, though moderate, would be considerably greater than the expense of steam. But still, if by the additional cost we should get rid of the vast and cumbrous machinery of the steam-engine, there are cases where it would be highly advantageous.

"Assuming, as previously stated, that 60 cubic feet per hour are equal to a horse power, it follows that 1000 cubic feet would supply a four-horse power engine for four hours. Now, since 30 atmospheres of gas can be compressed into the bulk of one, it follows, that a cubical copper vessel, scarcely exceeding one yard each way, would hold the quantity of gas required to work the engine for four hours. The engine itself is said to weigh only one-fifth part of the steam-engine. One of four-horse power might consequently weigh something less than a ton, while the locomotive steam-engine of the same power weighs four tons. Were engines of this description, therefore, adapted to locomotive machines, a four hours, or even a six hours supply of gas could be stowed into the machine, and all the bulky apparatus for manufacturing the gas, with the fuel, and part of the attendance, could be dispensed with. The extra price of the gas, compared with steam (and compressed gas would cost more than gas of ordinary densities), sinks into nothing in a case of this kind, where every ton of stowage gained may be worth 10s. or 20s. per day. If the machine fulfils the promise of its inventor, its value for purposes of this kind will, beyond a doubt, be very great."

A writer in the *Examiner* makes the following remarks. What he says of Mr. Brown's delay in furnishing the farther explanations naturally expected from him, is deserving of that gentleman's particular attention:—

"Mr. Brown has never, I believe, published any very exact data; all that I have been able to meet with are, that 'the patentee calculates on raising 200 to 300 gallons of water fifteen feet high, with one cubic foot of gas,' and that the vacuum produced is indicated by 22 à 24 inches of mercury: Dr. Fyfe says 24 à 26 inches.

"Now, allowing gas made on the spot to cost 5s. per 1000 cubic feet, 300,000 gallons may be raised 15 feet for 5s. without regard to time. In doing this, the water is admitted at once into the vacuum chamber, in the manner of Savery's, or rather Kier's steam engine, and there is no loss of power from complicated machinery; but supposing the vacuum perfect, the utmost height is only about 33 feet, and therefore this plan is of limited application; whereas, at some of the water-works, upwards of 160,000 gallons are raised per hour against a pressure equivalent to a column of 120 feet, at a cost of less than 5s. for fuel, which is equal to 1,280,000 gallons per hour through 15 feet, and this notwithstanding the complication of machinery necessary to work a forcing-pump.

"From such loose information it is almost impossible to ascertain the ratio that the gas consumed bears to the vacuum obtained, but it cannot be less than 2 per cent.; assuming that ratio, the application to an engine of small power will not at first appear so disproportionate. A six-horse engine has a piston of 14½ inches diameter, a stroke 2 feet 4 inches long, and makes 40 strokes or 80 exhaustions in a minute, and consequently requiring 12,843 cubic feet of vacuum per hour, consuming about 45 lbs. of coals, at most three-quarters of a bushel, which, at 42s. per chaldron, would be

10½d. per hour; whereas the gas, at 2 per cent. would be nearly 257 cubic feet, and would cost 1s. 3½d. But the power of gas will not come nearer to steam than 12 lbs. to 16 lbs. on the square inch, after deducting for the air-pump of the steam-engine; therefore a proportionate increase of capacity and expense will be required to equalize the power; the gas would therefore be 342½ cubic feet, and cost 1s. 8½d., nearly twice the cost of steam But this is supposing the vacuum could be made in the piston cylinder, which, I believe, has never yet been effected, nor is very likely to be: the vacuum is, however, obtained in the piston cylinder by transfer; that is, the cylinder full of air is opened into the vacuum chamber, and its contents equally diffused throughout the two. This method must be productive of great loss of power or gas; if the vessels are equal, one-half of the power will be lost. In one which I have seen constructed by Mr. Frasi, the proportion was 8 to 1; the loss of power was therefore 1-8th. But the cost for gas would be eight-fold, or 13s. 8d., being upwards of 15 times that of steam. This method of application may be varied, but will always be productive of great loss in some way.

"To the proposition of applying the gas vacuum engine to the purpose of moving carriages, another objection presents itself; the gas must be conveyed in a condensed state: if an engine on the principle above alluded to be used, and it was then proposed to be, it would require either a very large vessel or high condensation. The Portable Gas Company, I am informed, condense 16 times, which gives an expansive force of 240 pounds on the square inch; even with that condensation it would require a vessel of 171 cubic feet every hour.

"As to inertia and friction, I suppose them about equal in both cases.

"If this account should prove erroneous, I believe it will be from want of data respecting the gas engine, which certainly Mr. Brown might have furnished ere now. At any rate, it may serve to give an idea of the manner and necessity of calculating such questions."

PATENT METALLIC ROOFING.

Sir,—In perusing your valuable publication of the 12th of February, I observe, amongst the letters, one from Abel Handy, wherein he states a gentleman has obtained a patent for a Metallic Roofing upon an improved principle. As I am upon the point of entering upon an extensive building, I should feel obliged to Mr. Handy to point out to me, through the medium of your Magazine, which way I might address a letter to the patentee.

I remain, Sir,
Yours respectfully,
R. S. T.

Sheffield, March 9th, 1825.

CLEOPATRA'S NEEDLE.

From Travels in Egypt, Turkey, Greece, &c. By William Rae Wilson, Esq.

This stupendous object was presented, some time ago, by the Pacha of Egypt to the King of England; but great doubts have arisen as to the practicability of conveying it to this country, from its enormous weight, being 190 tons weight, and 70 feet in height. Among the various plans submitted there is one by a British Admiral, who surveyed it, which is as follows:—

"My humble opinion is, there is only *one* feasible mode, and, without any data, I should suppose the Romans must have used the same method to convey those masses from Byzantium and other distant places to Rome. The frame of a flat-bottomed vessel, fit to bear the weight of such a mass, should be formed in England, and sent out to the spot, and what in ship-building are called 'ways,' laid on an inclined plane, from the Needle to the harbour. An excavation should be made under one end of the obelisk, and a shore or prop placed under it. At a certain distance from that (depending upon the stability of the substratum) another excavation is to be made, and a second shore placed, and so on, according to circumstances. I think one at each end, and one in the centre, would answer; thus the obelisk would be suspended upon three points. The frame of the flat vessel might then be placed easily under it, and strongly fastened together, and then planked and caulked, taking care that the 'ways,' or inclined plane, be properly placed, the shores then cut away one by one, and the holes they make in the bottom closed up, and the vessel, which

will draw very little water, launched into the harbour, temporary masts placed in her, and, attended or towed by another ship, she might, I think, arrive in safety in the River Thames, pass under the bridges, and present herself opposite to St. James's Park, to which place it might be removed on rollers, and placed on 'ways' to the spot destined for its erection."

IMPROVED LATHE-CHUCK

Fig. 1

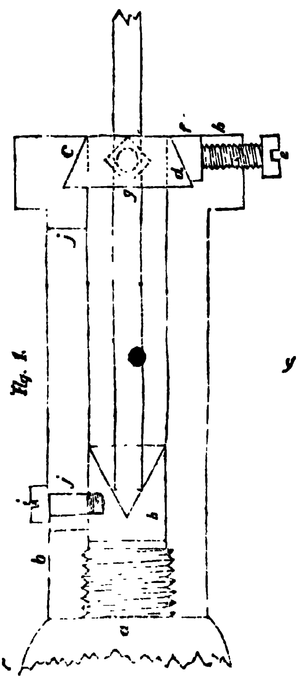
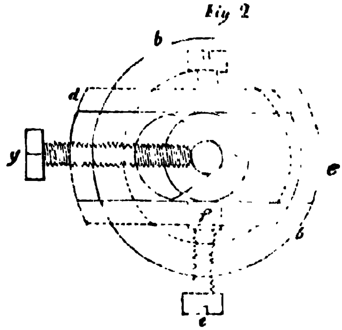


Fig. 2



Description of an improved Lathe-Chuck, for holding Cylindrical Metal Rods in, to turn Screws, &c. out of them. By Mr. FRASER, *Philosophical Instrument Maker, London. With an Improvement upon it by* Mr. THOMAS GILL, *one of the Chairmen of the Committee of Mechanics in the Society of Arts.*

The Chuck, as made by Mr. Fraser, consisted of a hollow cast-iron cylinder, about five inches long, fitted by a screw, upon the mandrel of his lathe, and having a dove-tailed groove made across the opposite end of it, in which a dove-tailed steel plate was accurately fitted, and could be secured in any required situation by a binding-screw. Fig. 1 is a longitudinal section of the chuck, and fig. 2 an end view of it; *a*, fig. 1, is part of the lathe-mandrel; *bb*, the chuck screwed upon it; *c*, the dovetailed groove; *d*, the dovetailed sliding-plate; and *e*, its binding-screw. Before the end of this screw, however, a metal block, *f*, is placed, to prevent the screw from galling the edge of the dovetailed slide. In this slide a hole or cavity is formed, having two flat sides, meeting at an angle, and a semicircle to complete it; in fact, it ought to be formed in its place in the lathe, by boring or drilling the larger

hole, and a succession of portions of smaller ones adjoining to it, by sliding the plate a little between each successive boring, until it arrives at the smallest, when the sides should be carefully filed flat; observing to take the bored marks as a guide for their accuracy. This plate should then be carefully hardened. Various sizes of cylindrical rods may thus be held in the cavity of the chuck, from one, as large as it will receive, down to very small ones; and they are pressed into contact with the flat sides of the angle of the cavity by the binding-screw *g*, and held fast. The slider, *d*, must then be adjusted, until the cylinder runs true in the lathe, and be secured by tightening the screw *e*.

The cylinder will thus be held centrally close to the slider; but as it is only confined within the hole in the slider, so it will require much care to preserve it central both within and without the chuck; and it is with a view to this, that Mr. Gill suggested the addition of the short hardened steel cylinder, *h*, with a conical cavity in it, and which is made to fit accurately a cylindrical hole, bored through the centre of the chuck, so as to slide steadily backwards and forwards along it; and it can be secured in any required position, by the tightening screw, *i*, the cylindrical stem of which passes through a longitudinal slit, *jj*, made in the chuck, and its screwed end fits into a screwed hole in the cylinder, *h*, its flat head binding upon the outside of the chuck.

It is evident that the cone will naturally guide the inner end of the cylinder centrally; and the outer end will, consequently, be kept central also; and, as the cylinder becomes shorter, in turning screws, &c. from its outer end; so, as it is drawn forwards out of the chuck, the steel cylinder, *h*, may be made to follow it up, by loosening and again tightening the screw, *i*, until the metal cylinder is become short enough not to need its assistance.

This improved chuck will be found much more convenient than the usual chucks, having three or four screws pointing to their centres, between which the cylinders are held in the lathe; not only as they will be less galled by the single screws binding upon them, than when held between the points of three or four screws. Nay, we have frequently seen a second set of three or four screws in the back part of such chucks, employed to retain the cylinders central in the chucks, and from the effect of which the cylinders must, of course, become still worse galled than when only a single set of screws was employed to hold them.

It is conceived that this improved chuck will also be found exceedingly serviceable in holding metal cylinders central, whilst drilling or boring them in the lathe, and which has hitherto been a great desideratum.

HIGH PRICE OF IRON.

English Iron, which, eighteen months ago, was 7*l*. per ton at the works, is now about 14*l*. per ton there. Now it is known that the ironmasters were not losing at 7*l*. per ton; at least they were able to keep up their establishments (particularly those who worked their own ore or iron-stone, as it is called); and it is equally well known by people who understand any thing about the business, that an advance of 1*l*. per ton yields a great profit to the masters, many of whom are making 200 tons and more per week. What, then, must be the present profits of these men, who have modestly advanced the article 100 per cent.? Perhaps it may be urged that ore* has advanced—that coals and wages have also risen: admitting this, still common bar iron, at 10*l*. per ton, would yield an enormous profit; but this is not all. It is a fact that, when iron was half the price it now is, it was made 20 per cent. better in quality than at the present time. Does not this circumstance, then, call for the interference of the Legislature in an article that provides and enters into almost every business and department of life, and is as essential to our comforts as any commodity we enjoy. I recollect, some years ago, when a minister (I think it was Lord Henry Petty) proposed a tax of 10 per cent. upon iron, the folly of such a measure was loudly inveighed against by the ironmasters, who, in a state of the greatest alarm, called upon every manufacturer and artificer to come forward and petition against a tax that would carry utter ruin into every branch of our iron manufactures, by depriving us of the means of competing with foreigners upon equal grounds. Yet

* Let it be remembered that the principal ironmasters are in possession of the mines; consequently any advance on iron ore and coals still goes into their pockets.

these same ironmasters have themselves taxed (advanced) the raw material to the artificer 100 per cent., or 10 times what the minister abovenamed proposed; by which exorbitant increase it is quite impossible that foreign orders on hand can be executed, or new orders obtained. In this extremity, then, I do hope that Ministers will not only reduce the tax on foreign iron, as the Chancellor of the Exchequer has proposed, but that they will entirely remove every duty or restriction that may now prevent its free admission into the kingdom. Let it not be supposed that I am advocating for a tax on English iron—I trust I never shall see such a measure take place; but only let us have a free import of foreign iron, and the price will soon find its own level.

T. S.

HINT TO BREWERS.

Sir,—I much wish, through the medium of your valuable little work, to recommend that the brewers in this great town try the effect of *double shafts*, so as to accommodate two horses abreast, as I think there is little doubt but that two horses, *thus situated*, would draw the weight required with the same ease as three horses in the ordinary way, which will be the means of saving one horse per dray, and prevent their blocking up the streets, as they now do, when several are following one another.

W. J. C.

INQUIRIES.

NO. 110—ELECTRIFYING MACHINES.

Sir,—I should feel myself much obliged to any of your ingenious Correspondents, to give me some information respecting the best sort of Caps for the Cylinder of an Electrifying Machine, and the cement (if any is required) most proper for fixing them on. I cannot succeed in fixing mine perfectly, for which reason they are constantly coming off. Some information respecting the Rubber would also be acceptable. Junior.

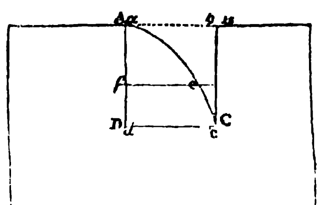
NO. 111.—SPRING WEIGHING MACHINE.

Sir,—By applying a Spring Weighing Machine (or, as erroneously called, Spring Steelyards) to a carriage, at the end of a long line, I found the weight of draught considerably greater than when a shorter line was used. Perhaps some of your readers will oblige me with an explanation of the cause.

I am, Sir,
Your obedient servant,
F. S. M.

ANSWER TO INQUIRY.

NO. 78.—RUNNING WATER.



Sir,—In answer to "Aqua," there is a Rule given in Marratt's Mechanics, as follows:—"The quantity flowing through a rectangular slit at the top of a sluice, kept constantly full, in the time T, will be ⅔ of what would run through the same area placed horizontally at the same depth from the surface." For the velocity of water, at the greatest depth, is to the velocity at any intermediate depth, as the square root of the greatest depth is to the square root of the intermediate depth; and by the property of curves (and areas), $\sqrt{ad} : \sqrt{af} :: dc : fe$, or the area of the parabola is equal to ⅔ of the rectangle.

"*Rule.*—$\frac{2}{3} \times 8.0208 \times$ area $\times$ time in seconds $\times \sqrt{}$ depth = cubic feet, or $5.3472 \times a \times t \times \sqrt{d}$ = cubic feet. Now this quantity reduced by multiplying by ·64, according to experiments made by Bossutt, in his Hydrodynamique, will give the true quantity discharged nearly."

I would next refer "Aqua" to the sets of experiments and formulæ given in the Encyclopædia Britannica, under the article "Rivers," where the for-

mulæ for open weirs is $D = 0.431 (\sqrt{2G}\, h^{\frac{3}{2}} \times l)$, or, more properly, $D = \frac{2}{3} l \sqrt{2G} (1-\left(\frac{m}{n}\right)^{\frac{3}{2}}) h^{\frac{3}{2}}$; where D denotes the discharge, h the depth, and l the length of the aperture.

Now, both these Rules will want correcting as the case may require, which correction will require the skill of the most experienced engineer, as the actual quantity of water flowing through apertures depends much on the shape of the channel, the depth and section of the aperture, and the weight of the atmosphere; therefore no standing rule can be given. But, as calculations are often required, and an approximation obtainable, I will, with your leave, introduce a few questions on water calculations, for the amusement of "Aqua" and other of your ingenious calculators, and, if necessary, on a future day, will give my own calculations and observations.

The two first questions require free ingress and egress to and over the board or weir—barometer at changeable.

1. What quantity of water, in cubic feet per minute, will flow over a board 3 feet wide and 4 inches deep?

2. What quantity of water, cubic feet per minute, will flow over a weir 50 feet wide and 3 feet deep?

3. With what velocity per second will a stream flow, 6 feet wide and 1½ feet deep, having a fall of 1 inch per 100 feet?

4. What slope is requisite to a stream of 20 inches per second velocity, 6 feet wide and 1½ feet deep?

5. What head or height of water will be produced by passing off 200 cubic feet per minute, through a space 6 feet wide? *

I remain, Sir,
Your well-wisher,
WILLIAM ANDREWS.

Tring, 10th February, 1825.

* Supposing a brook to be ten feet wide (excepting one instance, as per question), and the water in the brook being level with a canal, at half a mile distance, when the stream is shut in the reservoir above.

P.S. I understand there is an instrument sold in London, by which you may take the velocity of any stream, by inspection, when immersed in the water. The maker's name, price, and description of the instrument, will much oblige me.

NEW PATENTS.

To James Ayton, of Trowse Millgate, Norfolk, miller; for his improvement or spring, to be applied to bolting-mills, for the purpose of facilitating and improving the dressing of flour and other substances. Dated February 19.—In six months.

To John Beacham, of Paradise-street, Finsbury-square, Middlesex, cabinet-maker; for certain improvements in water-closets. Dated February 19.—In two months.

CORRESPONDENCE.

S. Y. does us an injustice with respect to his last published communication. If he will refer again to G. G.'s letter, he will perceive that it was to S. Y.'s former paper only that an allusion was made.

W. B.—We shall reconsider the subject.

T. R. L.'s design has our entire approbation, and shall receive our most cordial support. We shall be glad to have an early interview with him respecting it.

E. G. T. A. T.—None.

Communications received from—Mr. Bell—S. S.—Hob. Happer—A Drowned-out Collier—J. Armstrong—W. H. U.—Horace—F. J. M.—An Occasional Reader—Ra. Burton—S. D.—A Constant Subscriber—Alhidada—R. A. W.—S. G.—J. W.

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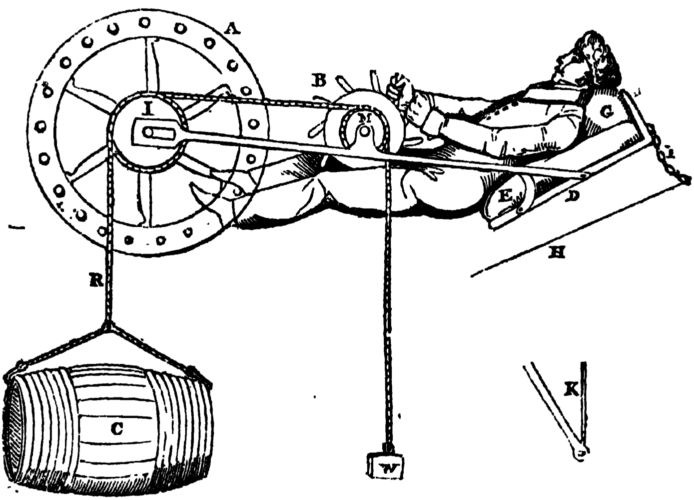
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 83.] SATURDAY, MARCH 26, 1825. [Price 3d.

"The Almighty has made men with arms long enough for any thing, if they would only stretch them out."—*Chatterton.*

PROPOSED APPLICATION OF HUMAN STRENGTH TO THE GREATEST POSSIBLE ADVANTAGE.



In the figure above sketched, is shown the whole strength of a man's legs, his arms, and the weight of his body, all concurring to raise the weight, C. Thus his legs, by means of his feet pressing against the rounds of the crane-wheel, A, exert a horizontal force in one given direction; his arms, in pulling at the handles of the lever-wheel, B, a similar one, but in an opposite track; and that there is a concurrence of his weight in giving added effect to these motions, on the principle of a lever application, is manifest.

The rope, R, making one or two turns round the axle, I, and the same at M, thence depends to W, which is a small weight, hung on merely to detain the rope from sliding round the axles by straining it tight. In place of this arrangement, there may be substituted an endless chain, passing over the two wheels, A and B. D is a board, which, in conjunction with F, sustains the man in the inclined position he occupies, ultimately determining the pressure of his weight *in excess* against or upon the steps of the crane-wheel, F being moveable on the axis at I. There is a pressure felt also upon his back and shoulders; to relieve him from the inconvenience attending which, the mattress, E, and

cushion, G, are provided, which also serve to hinder him, particularly the latter, from sliding upward, as he would otherwise have a tendency to do.

If at any time his arms become fatigued with the labour of *pulling* at the handles of the lever-wheel, B, he can conveniently give them relief by changing their mode of action to that of *pushing*, as against a cross bar placed between two supports (see fig. K) the doing which will give additional effectiveness to his weight, by depressing him lower down—a movement that will, of course, be determined to the crane-wheel by an added impulse to turn it round; and on occasion of his being required to put forth a more than ordinary share of exertion, he may proceed in this manner:—Setting his feet close together on the same step of the crane-wheel, his legs kept straight, and his knees firmly knit, he is then to press with all the force of his arms against the cross-bar, by which the utmost degree of power that human strength and weight combined are capable of exerting, will be brought into full and efficient action. A ratchet-wheel and catch being provided to render secure the attainment of every such effect as he may thus be instrumental in producing, a fly-wheel also might be added in connexion with the crane-wheel, to aid the man in the exertion of his strength by upholding an uniformity of motion.

In conclusion, it need only be observed, that to secure the individual at work from receiving any possible injury, the chain, L, is set on to the end of the board, and to a staple in the inclined floor, H, by which all tendency in the weight being raised to overpower that of the person and his strength included, is effectually guarded against; at the same it is to be considered, he has it always in his power to disengage himself, by only ceasing to place his feet on the steps of the crane-wheel. F. F.

NAVIGATING STEAM ENGINE.

SIR,—In your 77th Number I perceive a short account of a Navigating Steam Engine by D. Thomas: now, as he is, doubtless, an ingenious man, I will take the liberty of asking him the following questions:—

1st. Of what metal are the cylinders made of, to resist the action of cold water being thrown into them while red hot? as I know of none but what would soon oxidate, consequently impede the motion of the piston up and down, and soon render it useless by the leakage it would occasion.

2nd. How is the water forced into the cylinders, so as to produce an uniform motion in the engine?

I trust Mr. Thomas will not think, by my asking the above questions, that I doubt his assertions, or wish to deteriorate the merit of his invention—I can assure him that is not the case; but I think it a pity, that what appears to be a very ingenious invention should be disregarded for want of a more authentic explanation than is given in No. 77, page 322. I should think an engraving would contribute to elucidate the merits of the invention more fully, and certainly would be worthy a place in your useful publication. Perhaps Mr. Thomas, at some convenient time, will be kind enough to favour you with one. By so doing he will much gratify,

Yours, with respect,

R. FARLEY.

Rotherhithe.

IMPROVED MODE OF OPENING OYSTERS.

Our esteemed Correspondent, Mr. Bevan, recommends, as somewhat in season at this period of the year, the following mode of Opening Oysters:

"The mode I am about to describe has been practised with success for many years, and quite free from accident or disappointment; which is more than can justly be said of the common mode of digging with great force into the cavity of the oyster, with a particular knife, generally kept for that single purpose; whereas the improved method requires no particular form or size of knife, and, if necessary, may even be done with a common penknife! Previous to the use of a knife, take a common small pair of *pincers*, and break off about one quarter of an inch in depth from the thin edge of the oyster-shell, which requires no great skill or strength to perform; this operation will make a very visible opening into the cavity of the oyster, into which any kind of knife may readily be introduced, to separate the oyster from the flat shell, which renders the remainder of the process per-

-fectly easy. It may be supposed that the double process here described will require more time than the common mode; but a few trials will convince any person to the contrary."

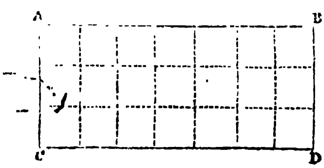
[We have been in the habit of cracking, or rather opening, our nuts on the same principle, in preference to using the ordinary nut-crackers. By cutting off a little of the sharp end of the nut, a small orifice is made; on inserting the point of the penknife into which, and turning it smartly round, the shell separates without noise, and the kernel is preserved whole.—Edit.]

MECHANICAL GEOMETRY—PART III.

(*Continued from p.* 408.)

THEOREM I.

Every rectangle is measured by multiplying its length by its breadth.



Let ABCD be any rectangle, and let AC be equal to three parts, which we will call inches, and CD be equal to seven of the same parts, we have to show that AC, multiplied by CD, will be the number of square inches in the rectangle ABCD.

Divide the side AC into three equal parts, and draw lines parallel to AB; also divide CD into seven equal parts, and draw lines parallel to AC, we shall find the figure divided into a number of squares which is equal to the product of the parts the lines AC and CD are divided into, which, in this case, is 3 multiplied by 7, and by counting the squares we shall find there are 21, which is the product of 3 multiplied by 7, equal 21, as we have by common arithmetic.

Cor. 1.—Hence, the content of a square is found by multiplying the side by itself, which, as all the sides are equal in length, amounts to the same thing as multiplying the length by the breadth.

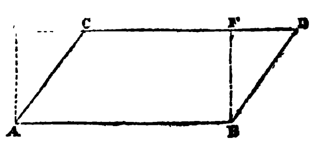
Cor. 2.—Hence, if any square is constructed, its side will represent the square root of a number answering to the superficial content of the square itself; thus, if ABCD represent any square, its content will be represented geometrically, thus, AB $\times$ AC, that is, AB multiplied by AC; but, in this case, as AB is equal to AC, we represent the square by AB^2 or AB $\times$ AB; that is, AB^2 represents a square, in the language of geometry, while AB represents a straight line on the side (or root) of that square.

Cor. 3.—Hence, also, we represent, in the language of geometry, the content of any rectangle by its length multiplied by its breadth, thus, AB $\times$ AC.

Note.—I have thought proper to add these two last Corollaries (though they are, strictly speaking, definitions), to avoid some inconveniences that the learners would feel in some of the succeeding Problems who are not acquainted with algebraic signs, and those, my geometrical readers, will excuse me, as I wish to make every thing clear and intelligent to every one as I proceed.

THEOREM II.

Every parallelogram is equal to a rectangle whose length is equal to one side, and width equal to the perpendicular distance of the opposite side; or, in other words, every parallelogram is equal to a rectangle standing on the same base and of equal altitude.



Let ABCD be any parallelogram; now, if we produce the side DC, and draw the perpendiculars AE and BF, we have to show that the parallelogram, ABDC, is equal to the rectangle ABFE.

Having drawn the figure or card, &c. as in the former Theorems (Parts

I. and II.), cut it out, and having, from the parallelogram, ABDC, cut off the triangle, BDF, we shall find, by laying it on the rectangle at ACE, it will complete it, by corresponding to the triangle ACE, by filling up the space ACE, which the figure ABFC wants to form the rectangle ABFE.

Or, more geometrically, having continued DC to E, and drawn the perpendiculars AE and BF, we have the quadrilateral ABDE, which exceeds the parallelogram in ABDC by the triangle ACE, and which also exceeds the rectangle ABFE by the triangle BDF; but the triangle ACE and BDF are identical, having the sides AE and BF equal to each other, and also the angles at A and E equal to the angles at B and F (by Theorem VII. Cor. 1. Part 1). Hence, if from the whole figure, ABDE, we take the triangle, ACE, we have the parallelogram, ABDC; from which, if we take the triangle, BDF, which is equal to ACE, we have the figure ABFC, which is less than the rectangle, ADFE, by one of these equal triangles; therefore, if the triangle, BDF, is added to the figure ABFC, we shall have the rectangle ABFE, whose length equals AB, and perpendicular BE, its width equal to the parallelogram, ABCD, which was to be shown.

Cor. 1.—Hence, if between any two parallel lines we draw a square, and on the base of the square we draw any two lines parallel to each other, the parallelogram so formed will be equal in area or content to the square.

Cor. 2.—Hence all parallelograms of the same breadth (or, in other words, on the same or equal bases), and drawn between the same parallels, are equal to each other.

Cor. 3.—Hence, also, the reason why we apply a rule down the centre of a plank, and take the width square across it, to find the content as we then reduce it to a parallelogram, whose length is the mean length of the plank, and width its perpendicular height.

G. A. S.

(To be continued.)

CAUSE OF HEAT PRODUCED BY FRICTION.

From the American Journal of Science and Arts.

I have made some attempts to explain the cause of the heat excited by friction, an account of which, I hope, will be acceptable.

In rubbing two bodies together, it is evident that the air in their pores and interstices will be compressed; and as air readily yields heat by pressure, it is possible that the heat excited by friction may be thus explained.

If two substances were rubbed together, and if, at the same time, there could be similar friction *in vacuo*, by a comparison of the results an opinion might be formed of the effect of air with friction in exciting heat. I mentioned this explanation to Professor Renwick and Doctor M'Neven; they thought it probable, furnished air-pumps, and assisted in making experiments.

A wooden spindle was fitted to a socket, and a similar spindle also fitted to a socket within the receiver of an air-pump; these were connected by a brass rod passing through a collar of leather, and being quickly turned by a cord, heat was readily excited; several trials were made, in all of which, except one, when the density of the air was diminished, less heat was excited. In that, about fourteen-fifteenths of the air was exhausted; notwithstanding this, the heat was greater within the receiver than without. In this instance pressure was applied as far as could be to allow the spindle to turn rapidly; the experiment was afterwards repeated with the same apparatus and gentle pressure, and the heat was much greater without the receiver than within.

Upon considering all the experiments, there appears reason to believe that air assists in exciting heat by friction, and the question arises, is it wholly by compression, or is there any other cause?

If the experiment should be repeated, it would be well to ascertain that the spindles excited equal heat—that time be allowed for the air to leave the pores of the wood—

and that the density of the air in the receiver during the experiment be noted.

JAMES T. WATSON.

New York, 8th May, 1824.

RAMAGE'S TELESCOPE.

Baron Dupin and Dr. Gregory, during an excursion in Scotland, were much delighted with the excellence of the instruments made by Mr. John Ramage, of Aberdeen, and the valuable observations of the heavens, which have been made by them, worthy of an observatory of the first order. They were astonished to find such inventive talents and knowledge in a humble tradesman, who devotes the leisure hours, spared from his business, to scientific pursuits, and whose knowledge and genius are only excelled by his great modesty and readiness to oblige.

One of these telescopes is placed at Broadford, near Aberdeen, in the grounds of Dr. Dauney, the professor of law. The tube is twenty-five feet long, and its diameter eighteen inches. At the bottom of the tube, when the telescope is to be used, is placed a metallic speculum, finely polished, of fifteen inches diameter. From this speculum a fine bright and clearly defined image of the body observed is reflected; and, as an eye-piece of only a small magnifying power is required, there is as pleasant and distinct a view as if the object was seen by the eye. The superior view of the heavens, as seen by such an instrument, can be appreciated by those only who have enjoyed the advantage of an observation with it. To produce any considerable power with a small telescope, deep magnifying eye-glasses must be used; consequently the field of view is much contracted, and there being but little light, the object is seen very unsatisfactorily. But with the large reflecting telescope the observation is one continued source of unmixed pleasure. Mr. Ramage's telescope is erected on a cast-iron platform, twenty-seven feet in diameter, on piles jointed and dove-tailed together. The whole was placed in a horizontal position by means of a spirit level. The centre post is about four feet deep. The telescope is moved round to any direction, on cast-iron rollers, by a winch at the end near the lower part of the tube and a rope. The tube of the telescope is raised to any altitude by the winch on the one side. When it is desired to be elevated to the zenith, or to any high elevation, the end of the tube is brought forward; the gallery on which the observer stands is raised by a similar winch on the opposite side. All the motions of the telescope are produced in the simplest manner by means of a few cords; yet the telescope is perfectly steady and free from tremor, and may be managed by the observer without an assistant, almost as easily as a three-feet achromatic telescope: this is a decided advantage, as the observer can place the tube in the most favourable position for vision better than any assistant. When the observer is in the gallery, he is able to keep the object a long time in view, as the telescope may sweep backwards and forwards ten degrees, and the observer may elevate or depress it and himself with one hand. The machinery of Herschel's twenty-feet telescope is very complicated, and requires two assistants. Mr. Ramage is now engaged in preparing a grand telescope, of which the speculum is fifty-four feet in length and twenty-one inches diameter. The casting and polishing of the specula and erection of the telescopes are done under his direction, and in a great degree with his own hands. The excellence and simplicity of management alike entitle the instruments to admiration.

MR. COBBETT'S FIRE-PLACE

SIR,—Mr. Cobbett, do what he may, or introduce what he may, is sure to meet with opposition from somebody, let him be ever so much in the right, or ever so little in the wrong. His Politics, his Locust Trees, and his Fire-Place, are all fallen foul of in their turn; and I verily believe, if he were to do the

most unobjectionable and most meritorious thing imaginable, there would be found some to doubt his good motives, and others to misrepresent them.

Concerning the American Fire-Place introduced by Mr. Cobbett, there is an article in the 80th Number of your Magazine, which, with your permission, I will observe on.

Your Correspondent, T. J., would have us understand, that he offers an unfavourable opinion on the American fire-place, lest any of your readers should be deceived into purchasing one by Mr. Cobbett's *puffing*, or, as he expresses himself, by that figurative writer's blandishments. This, it must be owned, is kind and considerate of him towards your readers; but, in reference to the industrious and talented politician, it seems to me to savour a little of illiberality. Surely, even if Mr. Cobbett has a pecuniary interest to answer, by the introduction of this fire-place (which I believe he positively states that he has not), he cannot, with justice, be accused of attempting to deceive the public in the instance before us, at any rate; he merely enforces, in his own peculiar way, what he considers to be the superiority of the American fire-place over the stoves in general use. *He gives his readers and the public an engraved representation of the fire-place commended by him*, and invites them all to see and inspect it. And what can be fairer than this?

To those who are fond of fires upon the hearth (and there are numbers who prefer them to the fires in an elevated position), the fire-place introduced by Mr. Cobbett is, I cannot help thinking, deserving of some attention. It may not look, perhaps, quite so well at first as the stoves we have long been accustomed to; but if it is calculated to save more fuel, and to give more heat than the common stove (which, from its construction, I have no doubt that it is); these are two prime qualities, which should, at least, obtain for it a politer reception than you and your Correspondent, T. J., seem disposed to give it. As to its being ineligible for cookery, this seems to me quite a mistaken notion. Why not roast at it — why not boil at it—when almost every old woman living in the country performs these operations by fires upon the hearth, and frequently without even the aid of wood as fuel?

To conclude, it seems to me that Mr. Cobbett's fire-place will do, at any rate, very well where *warmth and saving of fuel* are of greater consideration than beauty; and that, notwithstanding the reasons urged in your Magazine against its being admitted into the parlour, there will be found many who will be disposed to admit it there, when they learn that others have already done so, and that they like it very well.

I am, Sir,
Your obedient servant,

March 8, 1825. W. T.

CHEAP AND EASY METHOD OF MAKING SODA WATER.

Take forty grains of the carbonate of soda, put it into a common soda water bottle, which generally contains about ten ounces of water. Immediately afterwards, put into the same thirty-five grains of tartaric acid, then cork it quickly. The acid and the salt ought to be put in in crystals, as when in powder they are apt to seize upon each other before the bottle can be *well* corked, and so a considerable quantity of the carbonic acid gas which is evolved is lost.

In the above process, the tartaric acid having a greater affinity for the soda than the carbonic acid gas has, combines with it, and forms the tartarate of soda, a soluble salt. By this combination the gas which was engaged with the soda is evolved, or set free, and mixes with the water in the bottle, and makes its escape when the cork is withdrawn. —*Glasgow Mech. Mag.*

RAREFACTION OF AIR BY FIRE.

SIR,—The critical and philosophical observations of T. Hartshorne, page 274, on the Rarefaction of Air by Fire, having frequently occupied

my thoughts since I read his edifying paper, I find the more I think on that subject the less I know about it; and, like your Correspondent, candidly confess my ignorance, and freely allow, that although I am well aware pressure on water is lessened by fire, as well as by the removal of air, I always imagined the rarefaction of the air, in both instances, to be the same principle. I am now, however, of a different opinion, without being capable of conceiving wherein the difference consists. Indeed, if I did not know it to be the fact, that water rises in the tube which has fire over it, I would say it is impossible it could, as a scale of a conical shape, when inverted, and being in equilibrio, ascends, causing the opposite scale of the beam to descend, the inverted one having a candle flame under it. Now, the pressure on the other scale being unaltered, as well as that on the outside of the conical scale, the latter, I suppose, ascends from an increase of pressure on the nethermost or concave surface, which corresponds with a bladder of air forcibly expanding before a fire. So that, from the facts of water ascending in consequence of reduced atmospheric pressure, and the scale ascending in consequence of increase of pressure, the inference is nothing less than this paradox, that air rarefied by fire has a less and a greater pressure than the atmosphere as it naturally exists. That this is not the *rationale* of the experiments I am persuaded, as no doubt the phenomena arise from some common principle or unity of cause, but which it is out of my power to explain.

I am induced to trouble you with this declaration of my ignorance, in order to excite the learned and liberal to lend me their instruction.

I am, Sir,
Your obedient servant,
PHYLO SATES, A. M.

THE "QUESTION IN OPTICS."

SIR, — "A Much-amused and Constant Reader," at page 315, has attempted to give your Correspondent "S." an answer to his inquiry, page 253. "S.'s" inquiry runs thus:—What is the greatest distance at which the human sight, under the most favourable circumstances of sight and situation, can discover the hands and figures of an ordinary turret-clock (say four feet in diameter), so as to tell the hours?

Now your Correspondent, by some strange, unaccountable fatality, has at once assumed the distance without any previous investigation, for he says, that an object five feet in height (which, by the bye, is one foot more than "S.'s" inquiry), *and three miles distant*, &c. Now, Sir, any calculation, drawn from this assumption, can be no answer to "S."

Mr. Joseph Hall, too, in his correction of your Correspondent's mistake, has entirely overlooked what I have brought under review; and, besides, his solution is misplaced, for "S." does not want to know what will be the magnitude of the clock hands one foot distant from the eye. He wants to know at what distance they can be seen under every favourable circumstance of sight and situation; at least I understand him so.

Now, Sir, my method of solving this question would be this:—I would proceed to such a distance from the clock until I was almost about losing sight of the hands and figures; then my analogy would run thus:—As the magnitude of the object on the retina is to the radius of the retina, so is the magnitude of the hands and figures to the distance.

Your querist and his friends will say, "How are we to determine the two first terms of the analogy?" I answer, by referring to those rules already laid down by writers on optics; but, should this not be deemed satisfactory, allow me to add, that the human eye is a mere camera obscura, so that, by having an instrument of that kind, we may use this analogy:—As the magnitude of the reflected image is to the focal distance of the lens, so is the magnitude of the hands and figures to the distance.

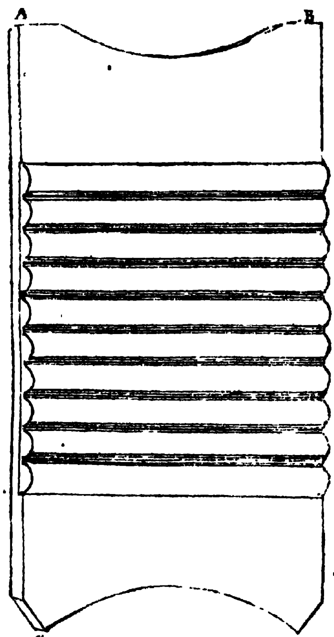
The distance, as measured by the theodolite, however, I would consi-

der far more accurate in a practical point of view.

I am, Sir,
Your obedient servant,
JAMES YULE.

P.S. I am quite aware that Mr. Hall only intended to correct your Correspondent's statement. So far he is right: but he might as well have answered "S.'s" inquiry at the same time, or, at least, have taken notice of that blunder which I have pointed out; and in not doing so he is so far in the wrong.

WASHING MACHINE.

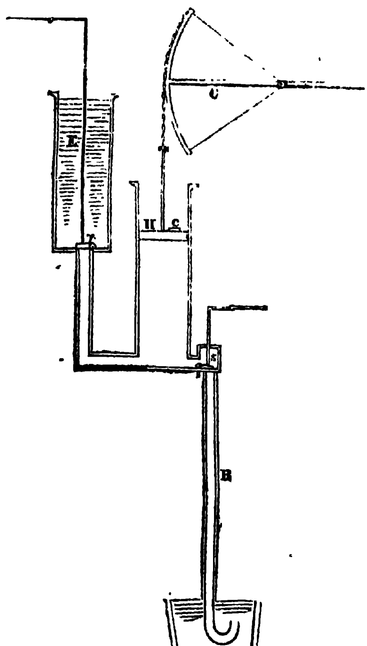


SIR,—I herewith send you a drawing and description of an Instrument for washing Linen, &c. which has lately made its appearance in my neighbourhood, and is much approved by the laundresses. It consists of a piece of fir deal (see the figure), ABCD, 22 inches long, 11 inches broad, and 1 inch deep, and into which is dovetailed another board, of beech wood, which is 11 inches square, and one inch deep, having 10 raised flutes or beads upon its surface. This instrument is put into a wash-tub, with water and soap, and the linen gently pressed with both hands upon the flutes, by which means the finest cloth may be washed without injury.

I am, Sir, yours, &c.
RA. BURTON.

Cottingham, Yorkshire.

AIR AND WATER ENGINE.



SIR,—While reflecting on the construction of the improved steam-engine introduced by Newcomen and Cawley, generally termed the Atmospheric Engine, an idea suggested itself to my mind, that water, applied as a substitute for steam (in order to form a vacuum under the piston), would produce a similar effect. I accordingly constructed a machine on this plan, on a small scale, and found it answered the theory exactly. The following brief description of it I submit to the consideration of your readers:—

A represents the section of a cylinder; B, a pipe of 36 feet, 34 feet of which will counterbalance the weight of the atmosphere; C, a main beam, with an arch and chain; E, a cistern, or reservoir of water; *r*, a valve to admit the water under the piston, H; *e*, a valve in the piston; *s*, a valve, to admit the water from under the piston to the pipe, B, in order to form a vacuum under the piston H. The whole action of the machine consists in opening and shutting the valves, *r* and *s*. First, open the valve, *r*, and the water will descend and force the air that is contained in the cylinder, A, through the valve, *e*. Secondly, open the valve *s*, with the valve *r* shut, and the water will descend through the pipe, B, and form a vacuum under the piston, H; consequently, the weight of atmosphere acting on the piston, H, will cause it to descend in the cylinder, A, and so on in succession, by the alternate opening and shutting the valves *r* and *s*.

I am, Sir,

Your obedient servant,

WM. TONKIN.

Beeralstone, Devon.

BEVEL CRANK, FARTHER IMPROVED.

SIR,—Observing in your excellent publication (Mechanics' Magazine), No. 81, page 392, the improvement which a Country Smith thinks he has made in the *Bevel Crank* in bell-hanging, I beg to inform him that, during my apprenticeship, *twelve years ago*, I made the *same kind of crank*, but with a still greater improvement with regard to the facility of acting. I thought, at that time, I was the inventor, but having, shortly afterwards, same bells to alter, I met with the very same description of crank, and was informed that it had been in use some years.

The difference between his crank and the one I am speaking of, you will perceive on reference to the one I now send you. Two plates, called flies, work upon rivets and mortices into the end of the crank, and accommodate themselves either to the bevelled corner or circular wall, by which means the crank acts with the greatest ease and precision. Your Correspondent's crank has only one plate or fly acting upon a centre rivet, which, though an improvement upon the old crank, is still, in a degree, liable to the objections he is endeavouring to remedy. If he will use the crank I have described, he will find it act far more pleasantly than his own. He will, I am sure, excuse my remarks, when I inform him my only object is to apprise him, and, perhaps, other country smiths, of an improvement in the art they follow.

I am, Sir,
Yours respectfully,
A LONDON SMITH.

[The model of the crank, politely transmitted with this communication, may be inspected at our publishers'. —EDIT.]

WEIGHT OF CARRIAGES IN MOTION.

SIR,—I was rather in doubt whether the question on the "Weight of Carriages in Motion," was not similar to that given by King Charles to the Philosophical Society for solution, which most of your readers are, no doubt, acquainted with; but a very parallel case occurs to me, which, I think, will throw some light on the subject; it is this:—We all know that a man can skate rapidly over ice which would not sustain his weight if he stood still, or even went only slower, because the time of his passing over is so short that it does not allow the ice to sink—his weight has not time to act fully. It would have the same effect on the weigh-bridge, if the cannon-ball were laid on it, and snatched up at the expiration of a time equal to the time in which it passes over the weigh-bridge.

I am, Sir,
Your obedient servant,
Δημιουργος.

March 10th, 1825.

SIR,—I am rather surprised that your Correspondent, Sam. Yelsap, should introduce so many seeming difficulties respecting a coach being lighter when in motion than at rest, when, I am confident, he must be well aware of the only solution that can be given to the question. I will proceed, however, on the supposition that he really wishes for the information he requests, and will endeavour to explain, as *familiarly* as possible, this *difficult* problem, and shall here take the question, as stated to be—a ball rolling over a weigh-bridge.

Now, we will first suppose the ball to be at rest on the bridge, when its weight, no matter whether caused by gravity or any other power, acts in a line perpendicular to the weigh-bridge, and therefore causes it to descend in proportion to this weight. We will next suppose that a progressive motion is given to the ball in a direction parallel to the plane of the weigh-bridge; in this case we have now two forces applied to the ball acting at right angles to each other, and if we represent these forces by the two sides of a right-angled triangle, they may, by the established laws of mechanics, be resolved into one force acting in the direction of the hypothenuse, but

the direction of this force is oblique to the surface of the bridge. Now, without entering into any mathematical calculation, it will be evident that the oblique force will have less power to make the weigh-bridge descend than a direct perpendicular force would; for every practical mechanic knows, that if we wish to draw a body along a given line, by a rope affixed to it, we must pull in a direction corresponding to that line, for, if we pull obliquely to it, part of our force or strength is expended in drawing the body from the direction in which we wish it to move; and thus, the more oblique the direction in which we pull, the less force is applied to the purpose intended; and thus, if we increase the obliquity of the pull, we shall, at last, exert our whole force in a perpendicular direction to the line in which we wish the body to move; and, consequently, if the body is kept from moving in that direction, we shall be unable to make it advance it all, but it will remain at rest; and thus we see, that the greater the force which acts in the direction of the horizontal plane is with respect to the force acting perpendicularly to that plane, the more oblique the compound force (arising from the double force applied to the ball) will be to the horizontal plane, and, consequently, the less power it will have to move the plane, on which the body rests, in a direction perpendicular to the horizon; and thus we see that the ball in motion over the weigh-bridge has two forces impressed on it (no matter what their forces are called), that is, a force in the direction parallel to the weigh-bridge, and a force perpendicular to it; and I have shown that these forces, acting both together, are the same as a force acting obliquely to the surface of the weigh-bridge, consequently its effect to make it descend is not so great as one perpendicular force acting in a perpendicular line; and thus we see that, without having recourse to any other solution than that which naturally arises from the consideration of the subject itself in a mechanical point of view, we are enabled to account for the seemingly paradoxical proposition of a coach being lighter in motion than at rest.

I am, Sir, &c.

G. A. S.

A FEW WORDS FROM A PRACTICAL SHIPWRIGHT ON THE "STATE OF SCIENCE IN OUR DOCKYARDS."

SIR,—On perusing the last Number of the "Quarterly Journal of Science," I found an article on the "State of Science in our Dockyards," written by Alpha, in which he has (I presume through ignorance) depreciated the merits and exertions of a most useful class of mechanics, particularly those upon whom the construction and improvement of the navy have hitherto depended; and the class of individuals to which he directs the public attention, are those who have been educated at the Naval Academy at Portsmouth, for the express purpose of being made officers in our dockyards; from whose acquired abilities he seems to anticipate a navy which shall far surpass our present one, and that of every other maritime power, in proportion as the scientific knowledge of the former is inferior to that of the latter.

Far be it from me, Sir, to contemn science, by which many useful and important discoveries have been made, that have greatly increased the comforts and conveniences of life; let me remark, however, that the utility of these discoveries was first established by experiment, without which all theoretical ideas are nugatory. I should, with Alpha, be disposed to anticipate much in the improvement of the navy from theoretical knowledge, were it not for those accidental circumstances and unknown causes which defeat the best calculations that can be made in the construction of a ship. The French, who are a scientific people, turned their attention to this subject many years ago, but have not yet succeeded in constructing and building ships superior to our own, though built, according to Alpha's assertion, by "knowledge derived from an imperfect experience." The workmanship and internal fitting of these ships are far inferior to ours; in this respect we are equalled only by the Americans. Alpha thinks it "remarkable that no improvements in naval architecture have taken place;" but I think it more remarkable that he cannot tell the difference between Noah's ark, a Roman galley or ship, and one of our first-rate men of war. In civil architecture scientific rules can be applied with precision, and the fabric is usually what was anticipated: but in naval architecture expe-

rience has proved that this is far from being the case.

Alpha has asserted as much as that a "calculus" is now formed and applied by the young men of the Academy, by which it would appear, that the sailing qualities and other properties of ships may be predicted previous to their being built and fitted for sea. This is raising the expectations of the public, and in a high degree warrants them to look for something pre-eminent in the construction and improvement of our navy. That such a "calculus" is made use of by them in the construction of ships, I am well aware; but the result has, I believe, disappointed the expectations of those who have made use of it, and the public in general. As yet, nothing pre-eminent has been achieved; and the ships thus constructed and built already, particularly the Regent yacht, cannot claim equality with many of those which have been constructed by "knowledge derived from an imperfect experience."

I think Alpha should at least have waited for practical proofs to justify his assertion, before he exalts the theorist at the expense of the practitioner. Iron is not less useful than gold, and in our dockyards it is a most valuable and an essential article in ship-building. Practical men are the most efficient; and it is to such the country has to look in times of emergency, for the building of those fabrics which are its glory and its defence. During a long war, which was attended with innumerable difficulties, such persons were usually employed from six in the morning to six at night, and frequently from five to seven, or nine, with a small interval for refreshment; under such circumstances it cannot be supposed that they had any leisure time to employ in theoretical studies, the result of which, in fact, would have been of little or no use to them in the execution of the duties they had to perform; and it will be well if the persons brought up at the Academy, when employed under the same circumstances, retain in their memories the portion of scientific knowledge they have been taught. How far the latter may excel the former in their exertions, is yet to be proved; and as it respects their practical talents, of which Alpha presumes to be a judge, I conceive that only practical men are capable of deciding.

Alpha has erred in supposing that science was not applied heretofore in the construction of our ships: just as much was applied as the result of its application proved useful. No naval architect can predict with certainty the depth of water to which a ship that is built will swim when launched, unless he knows her exact weight, and is certain that she is built strictly conformable to the constructed draught. Two and more ships have been built by the same moulds, and have differed in their draught of water from two to four or five inches, and the larger the ship, the greater the difference. This to a mere theorist is inconceivable; but wonder is often the effect of ignorance; and he who is cautious of predicting in this respect, discovers more wisdom and knowledge than he who charges himself with ignorance because of his silence.

It may be necessary here to give a general outline of the causes that defeat calculation in the building of ships. The constructed drawing by which the ship is to be built, is made by a scale of a quarter of an inch representing a foot, as a larger would be inconvenient in practice; it is then transferred to the mould-loft floor, a place appropriated for that purpose, of the full size which it represents; afterwards laying-off moulds are made to the lines, and bevellings given, by which the timber is prepared and trimmed for building the ship's frame. The process of laying-off on the floor is principally connected with that part of the ship called the frame or skeleton, and in the performance of this it is frequently found necessary, in making the body of the ship fair, to alter some of the lines taken from the body-plan of the drawing, as much as from half an inch to two inches or more; and in proportion as the drawing is unfair, these alterations unavoidably take place. Every rib or frame is composed of a certain number of timbers, called futtocks, the moulding sides of which are bolted together with a scarph, equal to half the length of the futtocks. The moulds, before they are used, and the futtocks, after they are trimmed, are liable to an alteration in their form by the weather; and the futtocks being bolted together alternately, with so short a guide for the moulding edges, cause the rib or frame to differ, in large ships, about two or three inches from the line laid down for it on the floor. When all the frames are completed, they are raised from the ground and put in their proper places; in doing which they are frequently so much strained, as to cause an alteration in their form, particularly in those which are very circular. As the in-board works are carrying on, the weight upon the shores causes the ground to settle, and the cleats, &c. connected with the shores, yielding in some degree to the pressure, the frames fall out, so that a large ship, when finished, has been found to increase in breadth from an inch and a half to three inches.

From the above statement of facts, it is obvious that very little dependence can be placed on the calculation of the ship's displacement, or, in other words, the depth to which she will swim when immersed. In entering into the calculation

of the ship's displacement, which is made from the constructed drawing, it is necessary to ascertain the weight of the materials of which the ship is to be composed. As this is attended with much labour, sometimes the weight of a ship of a similar class, and nearly the same tonnage, is substituted in the calculation (as the weight of a ship can be nearly ascertained when immersed); and should the calculated or substituted weight be erroneous, it follows that the displacement will be so in the same proportion. Taking all the above circumstances into consideration, who can predict with certainty the displacement of a ship?

Other calculations made from the constructed drawing, respecting the ship's sailing qualities, stability, &c. are attended with similar obstacles and uncertainties. Should the displacement be erroneous, which is more than probable, the centre of gravity of the displacement, as calculated, will be so too, and consequently the metacentre; and the centre of gravity being comparatively an assumed point, what dependence can be placed on the calculation of the stability of the ship? The calculation of the resistance that a ship meets with when sailing, appears as yet too imperfect to be relied on; and the centre of the moving power, or the centre of the wind's effort on the sails, cannot be correct, unless the masts are precisely in the same situation, and have the same rake as shown in the drawing, which, from accidental causes, is not at all likely to be the case.

It may be proper to observe, that to obtain by calculation the centre of gravity of a ship as fitted for sea, is a most laborious task, even by the shortest method; and should not every thing in and about the ship (including masts, yards, &c. &c.) be of the same weight, and in the same place as calculated, it would be abortive. Thus we have now most laborious calculations, which have not as yet produced any thing of importance in ship constructing and building, instead of that knowledge which is derived from practical observation and experiment.

Practical men of mechanical professions know that there are accidental causes and difficulties in workmanship that prevent the execution of many useful plans and inventions, the theories of which are correct; but this is what Alpha has not, it appears, contemplated. His speculative ideas of ship-building amount to little more than pleasant dreams, which time and experience may correct. He has, indeed, said as much in favour of the Academy (with which he says he is not connected) as he could say, and perhaps more than has been substantiated; but mere phrase is nothing: a counsellor can utter an abundance of these in favour of his client, by which the auditors may be amused; but facts, or strong circumstantial evidence, enable the judge to determine, and the jury to decide.

Fifteen years have elapsed since the establishment of the Academy, and it may now with good reason be asked, what has been discovered in the theory of ship-building more than was known before? and what are the practical results of the establishment?

Alpha conceives it to be a question of "grave consideration," how far it is proper to employ persons as master-joiners, who are also considered as foremen of the shipwrights. Perhaps it is a question of graver consideration, how far it is proper to employ them as shipwright officers at all, and whether it is not a bad application of their calculating talents? As the construction and improvements of the navy principally devolve on the surveyors (the laying-off and building of ships devolving on the shipwrights and their officers), a few of them might be employed as calculators under their superintendence; and the rest, probably with more propriety, might be placed as calculators, under the direction of the astronomer-royal.

I have to apologise, Sir, for the unusual length of this letter, but I trust you will see the importance of the subject is such as requires it. Why the merits of a practical mechanic should be despised, merely because he has not had the advantage of a boarding-school education, and has not been taught French, nor dancing and fencing, is what no truly generous mind can conceive.

The class of individuals whose merits Alpha has undervalued, was always equal, and more than equal, to the duties they had to perform; and their services merit not only the thanks, but also the favour and protection, of the public.

Should you, Sir, allow this a place in your most practical and useful publication, you will confer a great favour on those mechanics of whose merits and talents Alpha has so mean an opinion, and also on

Your most obedient, humble servant,

ANTI-CALCULUS.

P.S. I hope, Sir, you will excuse my phraseology, as I was not polished at *the Academy*.

CONCENTRIC CHUCK FOR TURNERS, INVENTED BY E. SPEER, ESQ.*

This Chuck consists of hollow truncated cones, fitting, with tolerable accuracy, into each other, the

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* The Society of Arts has voted its large silver medal to Mr. Speer for this invention.

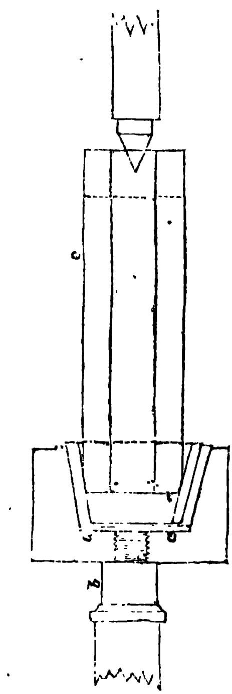
outer one screwing on to the mandrel of the lathe, and turned like a common chuck; at the bottom is a detached circular plate of brass, to force the cones out, in case of any adhesion; but I have never found this necessary. It is calculated to obviate a necessity for numerous chucks, which are applicable to different kinds of work, and to save a great deal of time, which is lost in preparing materials, when in the rough, for turning; in fact, it may be called a universal chuck, whenever the back-puppet is in use.

Every one acquainted with turning is aware of the trouble attending the first fitting a piece of wood to the lathe, which seems by this contrivance, simple as it is, to be entirely obviated. Nothing more is necessary than to remove one or more of the internal cones, till there is sufficient room for the admission of the substance to be operated upon; and it affords particular facility for removing any work from the lathe (a screw, for instance) which may require to be accurately fitted before it is finished.

The present chuck is adapted to receive any work between three and three-quarters and one-eighth of an inch in diameter; but there can be no objection to its being carried to any extent in size that may be required. It appears equally well calculated for turning brass, iron, or steel, the chucking of which is, in general, rather a troublesome operation; and it possesses one advantage, which is, I believe, peculiar to itself, namely, that it is impossible to injure the tool employed; for, as the work is carried round, merely by the friction on the inside of the cone, which may be increased or decreased at pleasure, by moving the screw in the back-puppet, in the event of a tool encountering a knot, or any other impediment, this friction is invariably overcome with less violence than would be requisite to break the point of the tool, and the work remains stationary.

The cones of this chuck are turned at an angle of about from ten to twelve degrees; but whether this may be the best proportion I am not prepared to say; probably, if it should come into general use, the angle might be determined by the kind of work to be performed.

I have had a chuck of this kind made in brass, with the cones of iron, but it is cumbrous and expensive, and does not answer so well, owing to the surface of the iron offering less resistance to the work within it. This perhaps might be remedied by roughing; but I think the chuck is much better in wood, as it can be made by any common turner at a trifling expense, and possesses more strength than can possibly be required.



Description.

The preceding figure is a section of a chuck, which consists of several hollow cones, placed one within another; the whole of them may be removed by pushing a pin through the screwed hole in the back of the chuck against the plate, *a a*; the plate, *a a*, must then be replaced. The hollow cones or chucks may then be easily pushed out from within one ano-

ther, till one is found that will receive the end of a piece of wood, &c. that is intended to be chucked; they must then be replaced in their respective situations in the largest chuck, and screwed on the end of the mandrel, *b*, of the lathe, as represented in the figure. The piece of wood, *c*, intended to be chucked, must then be pushed into the hollow cone, and the conical centre, *d*, (of the back-puppet) must be screwed against the end of the wood, which will cause sufficient friction within the chucks, so that the mandrel will turn round the chucks and the wood altogether.

These chucks will be found particularly convenient for chucking the outer end of any irregular piece of wood, when the centre, *d*, can be applied to the opposite end of it; and also for chucking a piece of wood that has been turned, when the centre has been cut off one of its ends. The chucks may be made of box, or any other hard wood that is not easily split.

PROMOTION OF EMULATION AMONG THE WORKING CLASSES.

Sir, — Encouraged by the very great interest evinced by you for the education and independence of the Working Classes, I beg leave to trouble you with a few hints on the subject, which, however cursorily thrown together, may possibly elicit from more experienced heads something beneficial to the interests of that most meritorious part of society, on the well-being of which, it may be justly said, depend the rank, wealth, and fame of this great nation. I am induced to hazard my opinions at this time particularly, in consequence of the announcement made, in the 77th Number of your Magazine, of Mr. Brougham's paper on "The Education of the Working Classes," as I detest pirating the opinions of others, or being supposed capable of doing so, as much as I feel tenacious of asserting the merit due to any degree of originality I may possess.

To confine myself to such limits as will not be trespassing too much on your columns, I shall, for the present, allude to one point only, wherein I imagine much mutual advantage would be promoted between master and man, if feelingly taken up and judiciously carried into effect—I mean the classification of workmen according to their merits

When one or two thousand men are employed under a common head, as in the service of Government, for instance, dissatisfaction, in some degree, is inseparable from difference of capacity in the same company of workmen, when the amount of wages depends on the general exertion, and individual pay is the same to all; or wherein an equal proportion of the amount of the week's earnings is the right of the worst, as well as that of the best mechanic. And as such difference of talent, in the customary mode of forming companionships, is as unavoidably collected together as it seems preposterous it should be so, some better mode of enabling each to have the full value of his exertions must be desirable to the men and to those over them, whose love of justice cannot fail of being excited, as their experience, discrimination, and sensibility, in numerous instances, discover occasions for the exercise of it. To remedy this evil, give a stimulus to exertion, and excite an attachment to the service, I would *classify the companionships;* limit the number of men in each class; put at once the very best workmen in the first, the next in ability in the second, and so on of the remainder; fix the daily or weekly pay of the classes on a graduated scale, and, as a vacancy occurs, fill it up from the next inferior class, the men of the superior choosing, by a majority of their votes, the mechanic most suitable to their own interests; and, lastly, leave each class the power in a similar manner, and after due notice to the proper officer, of ejecting an idle or incapable individual.

On this principle all would look forward with hope: indifference would find no lurking-place: dissatisfaction would be unknown, and the service would have a zealous supporter in every individual, which neither foreign nor domestic inducements could make him forsake; to which add the love of country—and a federal union, thus effected, would look on the *unholiest* alliance possible, formed against this country, with

the same indifference that time contemplates the ephemeral productions of art.

I am, Sir,
Your obedient servant,
AN AULD SERVANT OF GOVERNMENT.

IRON MASTS.

SIR,—At a period when Science is making such rapid strides, and its elements so generally diffused, even among the labouring classes, it cannot be matter of surprise that the public attention should be alive to any improvements in the form of our ships of war, to the conveniences afforded for their skilful navigation, or to any other circumstances which may place us higher in the scale of improvement than any other naval power.

The columns of our newspapers have been much occupied of late with accounts of the trials of the three experimental sloops of war, Champion, Pylades, and Orestes, and a deep interest has been excited as to the final result of those experiments; but this interest rests chiefly in the minds of those who are little able to judge of the value of the experiments in a philosophical point of view.

In the absence of data as to the relative sizes of the vessels, the area and form of their midship sections, the form of their fore and after bodies, their draught of water, the dimensions of their masts and yards, and area of their sails, no definite judgment can be formed of the merits of their constructors; for let it be recollected that the man who can build that ship which shall have a maximum of good qualities with a minimum of defective ones, under all circumstances of sailing, and in all states of the weather, and can do this, so as to carry the required number of guns, in a ship of the least possible dimensions (to secure good qualities) is to be considered, not only in an economical point of view, but in a scientific one, as the most skilful constructor. It is a well-known fact, that a person totally ignorant of the science of naval architecture can build, with success, a large ship to carry only those guns, and that quantity of stores, usually put on board a small one, and she shall have better sailing qualities than the smaller vessel, although the former shall be far inferior to the latter in scientific construction.

But, Sir, I look with a deeper interest to the result of the next cruise, than the quicker or less quick passage of these three sloops through the water, when I turn my eyes to the experiment which is being tried in the Phaeton frigate which accompanies them. This ship, it appears, has a main-mast and bowsprit of iron, made under the patent right of Mr. Robert Bill. If this plan should succeed, it will confer a benefit on the English nation of no mean importance; it will make us at all times independent of foreign countries for a supply of mast-timber--it will give an energy to British industry, and employ a large capital at home—it will decrease very considerably the expenses in the equipment of a navy; and, what is still of more importance, by the powerful ventilation which they afford, the health and comfort of the seamen will be promoted, and the durability of the ship ensured.

By a new and happy improvement in this species of mast-making, and for which the inventor has lately taken out an additional patent, masts can be made of the required strength, and still preserve a comparative degree of lightness: and further, iron masts may be taken out to foreign stations in small parts, built on board ship by the mechanical means which every ship affords, and thus render a masting-machine unnecessary. By this, in time of war in particular, a very great saving will arise. Added to all these advantages, an iron mast, even according to the present high price of the raw material, can be made at half the cost of one of wood, and will, most probably, last ten times as long.

I am, Sir, yours, &c.
Deptford, March 15th, 1825. C. P.

CORRESPONDENCE.

Amicus may forward the portion of his paper intended for our pages.

T.M.B. is referred to the article in our present Number, from "A London Smith."

Junius Anaxarchus will please to look to our notices to Correspondents in Number 75.

E.B.C.'s papers shall have an early place. His proffered observations on Locomotive Engines will be acceptable.

Communications received from—Haspy Smolet—A Lover of Good Things—C. J. K.—Aurum—T. W. S.—Enquirers—T. Hartshorne—Plato Mysshea—Dublini—Wm. H. C.—G. Scott—W. A. O.—Mr. Pasley—B. D.—An Amateur—Doverensis—Adam—T. S.—Old File.

ERRATUM.—Page 414, vol III. 2nd col. line 34, for 'provides,' read 'pervades.'

Communications (post paid) to be addressed to the Editor, at the Publishers', KNIGHT and LACEY, 55, Paternoster-row, London.

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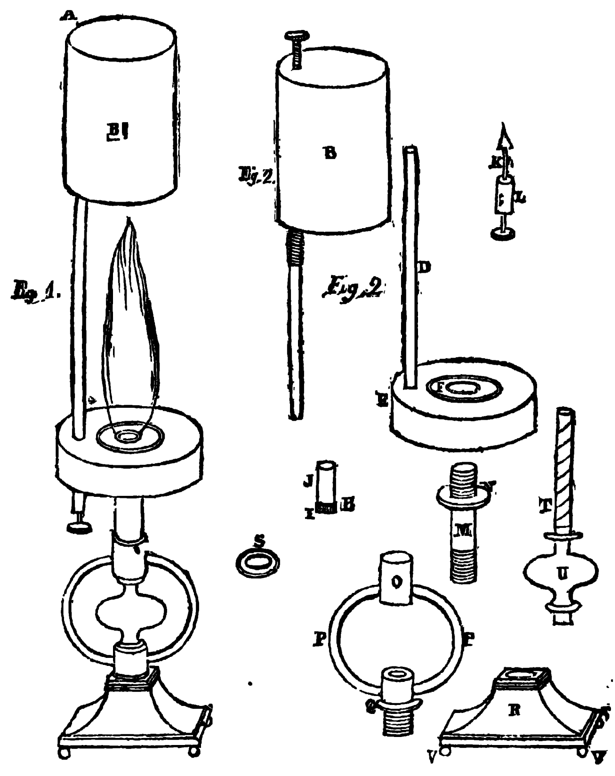
"It is more glorious to have extended, in the slighest degree, the limits of human knowledge, than to have enlarged the boundaries of empire."—*Cæsar.*

NEW TALLOW LAMP,

INVENTED BY MR. M. MONNOM.



NEW TALLOW LAMP,

INVENTED BY MR. M. MONNOM.

Agreeably to the request which we made in our 69th Number, Mr. Monnom has favoured us with the following more particular description of the New Tallow Lamp, invented and made use of by him in his trade as a watch-maker.

Fig. 1 is a perspective view of the lamp. It represents a standing light, but is instantly made portable by turning the screw, A, and taking away the reservoir, B, as is shown by fig. 2. A pipe projects from the bottom of the reservoir, and screws into the pipe, D, of E, the burner. F shows the top of the air-pipe, which moves the wick up or down by means of a pin, H, which projects inside the slider. I, a projection of brass to strengthen the slider, and make more hold for the pin, H. J is the slider, on which is placed a round wick. K, a screw and plug, fitted to the bottom of the pipe, D, of the burner, to regulate the running of the fat from the reservoir. L is a cap fitted with cork, and screwed on the end of the pipe, D, under the burner, to prevent the tallow's running from the joint. M is a pipe, big enough to contain the wick and slider. There is a groove cut down the inside to admit the pin, H, and keep the slider from turning round. N, a collar and screw, which screws into the burner, and forms part of the stand. O is a cup, with an inside screw, made to receive the end of the pipe, M. PP are two pipes, soldered to O and Q. This frame is screwed into the bottom, R, and forms the whole of the stand. S is a piece of leather, made to fit the cup, O, and is put on the air-pipe to secure the joint at T. PP acts as a spring upon the leather, and keeps the lamp from turning round with the ball, U. VVVV are four brass balls, to raise the bottom from the table, so as to admit the air to pass up the air-pipe, which gives life to the flame of the lamp. This lamp produces a clear and steady light, superior to any gas.

Street-lamps, carriage-lamps, or lanterns, may be made on my plan to burn twelve hours, without any alteration. Should any of your Correspondents wish to have lamps made on this plan, I shall be happy to supply them on moderate terms.

I am, Sir,

Your obedient servant,

M. MONNOM.

February 17, 1825.

FALLACY OF MR. ROBERTS'S EXPERIMENTS ON RAILWAYS.

SIR,—At page 381 of your useful and entertaining Publication, under the head of "Railways," I read the following notice:—"To set at rest a question which has of late been a good deal agitated, with respect to the velocity of a carriage, in diminishing or increasing the degree of friction on railways, Mr. Roberts, of Manchester, has made the following experiments." Then it proceeds to detail these experiments, which consist in a contrivance to make the railway move (on which the carriage rests), instead of the carriage itself, and by attaching the latter to a post, to which also has been affixed one of Mariott's weighing machines. The force with which the carriage pulled when the railway was put in motion under it, was held to be the measure of the friction, and the result was found to be, that an uniform force was exerted, under every change of velocity.

Now, really, Sir, the confidence with which this question is said to be finally decided is quite astounding, and it may argue great presumption in me to call it in question, or attempt to contravert it; but, in my simple opinion, the experiment itself amounts to nothing, and the result which has been obtained, is what any one might have anticipated by a little attention to its parts. One great error that I consider has been committed, is in supposing it the same thing whether the heavy body itself moves, or the railway that is under it, for the result of the experiment with the latter motion is totally at variance with what experience proves to be the fact with the former, viz.—that the gravitating or downward force of a heavy body may be, in whole or in part, suspended by a superior force pressing it with different degrees of velocity in a different direction. For instance, it is a well-known axiom, that the faster a carriage moves, the lighter it becomes; and that when once a force has been exerted to give it an accelerated movement, a smaller force will serve afterwards to keep up the same degree of velocity. Assuming this then to be the fact, which I believe is incontrovertible, how comes it, if it were not for the reasons I have here stated, that a greater force being required to overcome the resistance in the first instance, the continuance of the same degree of force is not required afterwards, if the resistance of the weight and friction be the same (as Mr. Roberts thinks he has proved), whatever be the velocity?

It so happens that in the same Number (80) of your Magazine, in which this decisive experiment of Mr. Roberts is inserted, I am furnished with a more convincing proof, "that velocity diminishes

weight," by a question which a Correspondent (Mr. Yelsap) asks, without reference to this question (see p. 375), viz. "Why does a coach in motion press a weighbridge less than when it remains in a state of rest?" or, to simplify it thus, "Why does a cannon-ball press upon a weighbridge more when at rest than when in motion?" In other words, "How is gravity suspended by motion?" Here, then, by this simple question is the fact I undertook to prove ascertained (for without gravity there can be no friction), and the writer only wishes to know the cause of its diminution, which must be sought for in the propelling power. But, in short, this principle was so well understood when I was a boy at school, that I have frequently, with other boys, propelled myself with such velocity, as to slide across a piece of ice that would not, for ever so short a period, support my weight; and when I have again attempted it with a diminished velocity, it has given way under me. Is not this a convincing proof, that the weight or pressure in the two instances was different, otherwise in the latter it would not have given way?

Having given these instances of a partial suspension of gravity by motion, I will state one where it will be seen to be wholly suspended, or cease to act, and which I expect may be deemed in a great measure conclusive, viz.—that wherein a cannon-ball (whose gravity we may call 24 pounds) is propelled in a point blank horizontal direction, say 2000 yards, before the velocity of its force becomes diminished, and it inclines towards the earth. Here, then, for this entire space of 2000 yards, we have a gravitating force of 24 pounds entirely suspended by a propelling movement; and it is only at the end of this great distance that the movement becomes impeded by the resistance of the atmosphere, and the gravitating power begins to act and make it descend.

This I consider sufficient evidence to show why I dissent from the conclusion Mr. Roberts has come to, viz.—that friction of the same body is the same under all degrees of velocity; and if my theory is correct, which is what has hitherto been believed to be the true one, before this supposed discovery of Mr. R., it still remains a desideratum in science to discover the means of measuring the friction of a body under different degrees of velocity; for, with the little knowledge I have of mechanics, and I confess it to be but little, I consider this contrivance of Mr. R., however ingenious, does not accomplish it.

I have to apologise, Sir, for troubling you at such length; but as your object in publishing different opinions is, if possible, to elicit truth, perhaps you may deem this to be worthy of insertion; in doing which you will oblige, Sir,

Your obedient servant,

A Constant Reader.

No. 1, Woburn-place.

Sir,—In your 80th Number, p. 381, you have described an apparatus made by one Mr. Roberts, for the purpose of setting at rest the question on Railways. We practical mechanics do not understand what is meant by this expression, as we cannot see the use of this apparatus, or that it has shown any thing different from what was before generally known. We all know that the power required to overcome friction on railways, &c. must be increased with the speed; that is, for instance, if a double speed is wanted, a double power must be applied for. Supposing there were only friction to overcome, and that friction were equal to 150 pounds, it is clear that this resistance, at two miles and a half per hour, will be equal to a horse's power; but if you alter the speed to five miles per hour, it will require two horses' power; at least it will take a steam-engine of two horses power to drive it; and if you farther increase the speed to ten miles per hour, it will require the power increased in the same proportion. Although we do not take the resistance of the air into the account, it has been found by experiment, that in a still atmosphere, a square foot surface, moving at the velocity of ten miles per hour, experiences a resistance equal to 492 pounds; and if a carriage on a railway contained 20 square feet front, it would be thus: $20 \times 492 = 984$ pounds, the whole resistance; but if going against the wind at that speed, and the wind blowing at ten miles per hour, this would be equal to the speed of twenty miles in a still atmosphere; and as the resistance of air increases as the square of the velocity, it would be $= 9.84 \times 4 = 39.36$ pounds. Great as this resistance is, yet it does not increase like the resistance of water on canals, &c. A Correspondent, in Number 72, p. 247, has a strange and evidently fallacious way of calculating those resistances; but in Number 79, p. 359, we meet with a writer of a different cast, who no doubt understands the subject, and if he has more time to write than me, I hope you will hear more from him. I shall only mention that the resistance to vessels on canals, &c. will be found to increase in a higher degree than the square of the velocity. Light fluids, as air, which may be said to be without weight, will resist as the square of the velocity; but heavy fluids, like water, will resist as the cube of the velocity. For example, a double

velocity cannot be obtained from water but by increasing the column four times; and, as Mr. Smeaton says, that where the velocity of water is double, the adjustage or aperture being the same, the effect is eight times; that is, not as the square, but as the cube of the velocity. Now, there can be little difference whether the body move against the water, or the water against it; therefore a vessel moving at a double velocity must be resisted by double the quantity at double the velocity, which is $2 \times 2 = 4 \times 2 = 8$. We find in water-mills, where we have a certain quantity passing through the sluice aperture in a given time, and say the effect is equal to one; but when the head-water, or column, has risen four times the height above the aperture that it was in the first instance, there would double the quantity pass this given aperture in the same time. Now, as the power of water-mills is best found by making the water act on the wheel by its gravity, four times the fall or column will give four times the power; and as double the quantity passes in the same time, double the quantity would always be on the wheel, which also doubles the power; therefore $4 \times 2 = 8$ times. So that when a vessel is made to force its way through water at a double speed, it must be resisted four times, and at a double velocity, which makes it equal to eight times, namely, as the cube of the velocity.

We are wandering, however, from our first subject, viz. Mr. Roberts's model, to which let us return. It has been stated, that were a weight equal to 100 pounds suspended over a pulley, and the end of the line connected to a carriage on a railway, and that this carriage took 90 pounds to put it in motion, that in time the carriage would accelerate to a great speed, until counteracted upon by the air. This, I suppose, no one will deny; but the faster it runs, the faster are we spending our power, for the faster is our wound-up weight sinking; so that we just come to where we set out, viz.—the power to resist friction must increase with the speed.

I am, Sir, yours, truly,

W. D.

THE BALANCE QUESTION — FRICTION ON RAILWAYS.

Sir,—I beg leave to step forward to give my opinion on a question which appears to me to be treated by your Correspondents in a very erroneous manner, and I come forward on the present occasion not only to endeavour to set your Correspondents right with respect to it, but also with a view to check that spirit of presumptuous triumph which is too visibly manifested by your "Young Engineer."

In speaking of the Balance Question, G. B. says, "the reason of this is so clear, that it would indeed be singular if it were otherwise." I say so too. S. Y., on the other hand, says, that a pressure infinitely great, exerted in the way G. B. describes, will not increase the weight one grain. There is, indeed, a nice distinction between the words *weight* and *pressure* in a philosophical point of view; but, on the present occasion, I shall consider them as synonymous, as this, I believe, will best correspond with the general ideas of your readers. Then, suppose a balance to be loaded with equal weights. If, in this state, we step under the beam (standing on the ground), and apply an upward force of 30 pounds to the middle point of one of the arms, it is manifest, from the properties of the lever, that 15 pounds put into the scale which hangs from the same arm would exactly be a counterpoise to the 30 pounds. Now, let the man step into one of the scales, and let him be counterpoised by weights put into the opposite scale; if, then, in this state he presses upward with a force of 30 pounds on the middle point of the same arm from which he hangs, it is evident, from what we have already stated, that an additional 15 pounds thrown into the same scale would exactly balance the upward pressure of 30 pounds; but, since action and reaction are equal and opposite, the man necessarily throws 30 pounds into the scale, which is, in fact, 15 pounds more than is necessary for restoring the equilibrium. What, then, is to be the consequence? Why, it is too apparent. All your other Correspondents say that it is owing to the elongation of the arm that the scale descends, but, as G. B. very acutely remarks, page 308, *the swinging cannot alter the point of suspension.*

Should your readers not see clearly through this remark, let them read page 408, vol. I. of the Mechanics' Magazine, and they will there perceive that oblique action has nothing

to do with the descent of the scale; but, should that article not be convincing enough, let me still further observe, that in all cases of oblique action there is a loss of power proportionate to that obliquity; consequently, according to that principle, there is a portion of the man's weight lost; hence the scale ought to *ascend*. But, say my opponents, the arm of the beam becomes virtually longer, or the point of force protrudes farther from the fulcrum, and this causes it to descend. Well, let them have it so; but they will allow me to say that this protrusion or elongation is always proportionate to the loss of power arising from the oblique position of the scale; so that, in this way, an equilibrium would constantly obtain. Your Correspondents will, therefore, perceive that all the demonstrations and explanations that they have given are not sufficient to account for the descent of the scale.

Mr. George Gregory, at page 361, has attempted to give us a trigonometrical solution of the fact, when the scale is prevented from being thrust out of the perpendicular position, but it only proves that the oblique force : direct force :: as radius : the sine of the direct force. This is, in fact, proving nothing, since oblique action is not the cause of the effect produced; but, suppose hat oblique action were the cause of the descent of the scale in this instance, then Mr. Gregory's solution carries a manifest contradiction on its face. Let us hear what he says, "Then, by the revolution of forces, it will be revolved into the two, HA, AG, (vide page 361); but AG is in the direction of the beam, *therefore it can have no effect in turning it about its centre;* hence AH is the direct force." Now, Sir, for the sake of your less informed readers, I may just observe to them that Mr. Gregory's meaning is this:—*that, because the man's weight has grown lighter, the scale must necessarily descend!!!* This, in fact, is the sum total of his solution.

Mr. C. Eagland says, that he tried the experiment by putting a piece of wood into the scale, and attaching it firmly to the beam, in imitation of the man's grasp, and that the same effect followed. How could it be otherwise? The piece of wood thrust the scale out of the perpendicular position, thus causing a corresponding action upon the arm, arising from the centre of gravity of the scale endeavouring to fall under the point of suspension of the scale; and this mechanical action pressing upward against the arm, explains, in a very clear manner, the descent of the scale, according to what I have already stated.

Your "Young Engineer," at page 393, attempts to prove to G. B. what he had promised at page 278, but I need not trouble you with a review of it—it carries its own refutation along with it. Indeed, Sir, taking all things under consideration, G. B. has pointed out the method of solving this question more philosophically than any of your other Correspondents. You will observe, I am speaking of his method, not of the conclusion he has drawn from that method.

S. Y., at page 394, puts a question to me. Now, I have no objection to answer it, for the sake of your other readers; but why should I do it for him, when he says, at p. 358, that he admits it, namely, the position advanced by me at page 308? By-the-bye, Mr. Editor, his letter is a laughable one: let us look at it, if you please. At page 358 he quotes a passage from 239, and, after having read it, he sullenly exclaims—"*this I deny.*" Immediately after this he cites another passage, which, you will observe, is exactly the same proposition, couched in different words, and, after having read it, he exultingly exclaims—"*this I admit!* it is conformable to the experimenta of Mr. Professor Vince." Then, after giving us a great deal of intricate calculation, which, I confess, is far beyond my comprehension, he goes on to state that 158 pounds moved through 20 miles have expended 2000 pounds in balancing the friction alone (*all this may be true, from the nature of your engineer's machinery!*); "and yet," says he. "the writer alluded to has the har-

dihood to assert that, speaking practically, it would cost no more to command a velocity of 20 miles an hour on a railway than a velocity of one."

Now, Sir, if I may be allowed to draw an inference from the above statement, S. Y. denies what a little before he admitted, and even insinuates that the conclusions drawn by the writer of the article on Railways are not strictly conformable to the experiments made by Vince and Coulomb. Now this is sufficient proof to me that he knows nothing of the experiments made by these gentlemen. For his instruction, however, I can inform him that, according to the experiments of Mr. Vince, *friction is an uniformly retarding force, and always corresponding to the time.* Those of Coulomb are somewhat different from Mr. Vince's, for he concludes, *that all things being alike, the friction is proportional to the pressure.*

S. Y. further says, "I am essentially a practical man, and am proud, very proud of belonging to so useful a portion of society—to a portion who could claim among its members a Smeaton and a Watt." This may sound all well enough, but some people are proud of making a merit of necessity; moreover, Watt and Smeaton were men of genius, and, as such, I consider them as theoretical men, for "genius is the gift of God, which learning cannot confer." Practice may hold the helm, but theory must guide the bark. Although Watt and Smeaton have sprung from the same class of society to which we belong, that is no reason why we should content ourselves to drag a life of drudgery and toil under the mercenary eye of, perhaps, a tyrannical master. No, Sir, let us use our honest endeavour to get rid of those slavish trammels; we have now the blessed opportunity, through the pages of the Mechanics' Magazine, of unfolding our minds (each in his own way); we have now opportunities that Watt and Smeaton never enjoyed; let us, therefore, do what we can to better our condition, and, as Mr. Bevan remarks, page 199, vol. I. "Nothing is accomplished without labour, and nothing is denied to application and perseverance."

I have been induced, Sir, to enter thus fully, or rather, I might say, superficially, into the merits of S.Y.'s communications, with a view to check that impetuous spirit by which he seems actuated, and which is evidently carrying him beyond himself, and, if not timely curbed, will lead him at last to the most erroneous notions in matters of science. You will, perhaps, say I have been too severe; I grant I have been severe, but "he who spareth the rod hateth the child." I shall always be happy to meet S. Y. in the pages of the Mechanics' Magazine, but with a less imperious tone than he has heretofore assumed. I would feel satisfaction in assisting him in his mechanical studies, so far as my abilities permit, and it will always yield me pleasure in answering those queries which he may, from time to time, insert in your journal.

Having, in this letter, made such an open attack upon many of your Correspondents, I consider it but justice that they should be in possession of my real address, that I may openly and fairly meet their charge; and, as my friends in the North used to say, that there was never "*muckle luck attendit ony body that had twa names,*" I therefore beg leave to subscribe myself,

Your obedient servant,

James Yule.

63½, Red Lion-street, Clerkenwell.

RAW AND BOILED EGGS.

Sir,—I conceive the difficulty of spinning a raw egg (stated by Nicol Dixon, page 374, vol. III.), arises from this cause:—We know that if a cup containing water be turned round quickly, the cup may be turned for a considerable number of revolutions, whilst the water remains stationary or nearly so; this, in a degree, must be the case with the egg. When you spin a raw egg, the fluid within having a tendency to stand still, the friction of the liquid against the inside of the shell, in consequence of its not being round, pre-

vents its spinning; but, if you continue to spin it, by degrees the fluid will revolve too, and then the difficulty ceases; as I have found, on trial, that a boiled or raw egg, applying, as nearly as may be, the same force in spinning them, will continue to spin nearly the same time; but the boiled egg spins much the faster at first, till the fluid within the raw egg revolves with the shell.

I am, Sir,
Yours sincerely,

Δημιουργος.

March 10th, 1825.

SELF-REGULATING PENDULUM.

Sir,—Having seen, in Number 77 of your valuable Magazine, a description of a very ingenious Self-regulating Pendulum, but rather of a complex nature, I am induced to submit to your notice one much more simple, which is applied by Messrs. Barraud, Cornhill, to their astronomical clocks.

Description.

The preceding drawing represents the pendulum rod, with the external frame, enclosing a cylinder of glass fixed in the frame, and filled with mercury up to the dotted line. Now the way this pendulum adjusts itself, is by the expansion or contraction of the two metals; for in hot weather the rod will expand or lengthen, at the same time the mercury in the cylinder will rise, and in cold weather the rod will contract or shorten, and the mercury in the cylinder will fall; consequently the vibrations of the pendulum are always equal.

I have witnessed its performance myself, in an astronomical clock (by Barraud) in the possession of a gentleman whom I am intimately acquainted with, the clock having gone from March 24th to June 20th, without deviating but two minutes six seconds from Greenwich mean time; during which time the thermometer was from 37° to 69°.

From yours, truly,

R. Farley.

Rotherhithe, Feb. 28th, 1825.

THERMOMETRICAL DETERMINATION OF HEIGHTS.

Sir,—Allow me to direct the attention of your readers to a branch of philosophical inquiry, which, while it yields a rational pastime, cannot, at the same time, fail of giving the most instructive lesson to those of them who are cultivators of the ground.

It is an universally received principle, that as we ascend in the atmosphere there is a gradual diminution of temperature, and, although the decrements of heat, at equal ascents, are not altogether uniform, but advance much quicker in the higher than in the lower regions of the atmosphere, yet, as it regards the Island of Great Britain (whose highest arable lands are not far above the level of the sea, comparatively), we may, perhaps, be sufficiently near the truth to assume the law of equable progression. According, then, to the delicate and patient research of a certain celebrated philosopher, we may allow one degree of cold, by Fahrenheit's scale, for every 90 yards of ascent; so that, according to this rule, by having the medium temperature corresponding to the latitude, we may trace out a curve over the island at which eternal frost prevails, and which may be called

the curve of congelation, corresponding to 32° of Fahrenheit's scale. Now, in order to discover the medium temperature at any degree of latitude, Professor Mayer, of Gottingen, has given us the following formula :—29 cosine L^2 will express in degrees, on the centrigade scale, the medium heat of the coast. L, in this formula, denotes the latitude of the place at which the observation is made.

From the two preceding rules I present your readers with the following table :—

Latitude.	Mean temperature at the level of the sea. Centrigrade	Fahrenheit.	Height of curve of Congelation in ft.
50°	11.°98′	53.°6′	5832
51	11. 49	52. 7	5589
52	10. 99	51. 8	5346
53	10. 50	50. 9	5103
54	10. 02	50. 0	4860
55	9. 54	49. 2	4644
56	9. 07	48. 3	4401
57	8. 60	47. 5	4185
58	8. 14	46. 6	3942
59	7. 69	45. 8	3726
60	7. 25	45. 0	3510

An example will best illustrate the use of this table.

Suppose we are on a spot of elevated ground, in the latitude of 51°, and we find the temperature to be 43° by Fahrenheit's scale, then the standard temperature at that latitude, according to the table, is 52° 7′; then 43° subtracted from 52° 7′ = 9° 7′, and this multiplieo by 270, the number of feet in 90 yards, is equal to 2619, the height of the elevated ground above the level of the sea. Otherwise, thus: 32° subtracted from 43° = 11°, which, multiplied by 270, = 2970, = the number of feet below the point of congelation; and this point being, by the table, 5589 feet above the level of the sea, consequently 5589 − 2970 = 2619, the height, as before.

It is not, however, to be expected in a fluid such as our atmosphere, which is subjected to so many changes arising from moisture, winds, reflected heat, &c. that we can look for that consummate harmony and order which prevail in the sublime science of astronomy; at all events, this simple method of determining heights by the thermometer, deserves to be more generally known.

I shall therefore conclude this paper by mentioning a circumstance, which shows, in a most remarkable manner, its near coincidence with strict geometrical accuracy. A gentleman at Edinburgh observed the temperature of Crawley and Black springs, on the ridge of the Pentland Hills (near Edinburgh, about latitude 56°), immediately upon their issuing from the ground, to be 46° 2′ and 45°, respectively; which, from the mean temperature at the same parallel, would give 567 and 891 feet above the level of the sea by the table. Now the true heights, as found by levelling, were respectively 564 and 882 feet—a coincidence which is most surprising and satisfactory. Hoping that my time has not been mis-spent in drawing out this paper,

I remain, Sir,

Your humble servant,

James Yule.

63½, Red Lion-street, Clerkenwell.

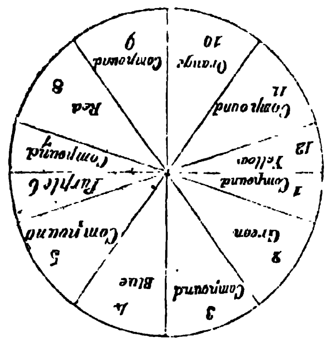
TRUE AND APPARENT LEVELS.

Sir,—In your 82nd Number, page 407, a Correspondent, who immediately follows your ancient friend, "Bibo" (who, by-the-bye, had better "trim his boat, and be quiet"), wishes to know if the surface of the water in his aqueduct would be a true or apparent level? I answer, that he may rest assured that it would be a true level, corresponding to the line DKC in his diagram. The useful inference which the writer thinks might be drawn from his query being satisfactorily answered, would certainly be interesting. Your Correspondent, however, labours under a mistake when he says that the apparent line of level, DMC, will appear strictly level to the eye. This is not strictly true, for, to a person placed at M, the lines MD, MC, would ap-

pear like two vast inclined planes, of which CN, DL, would be their perpendicular heights, and were a ball placed at C or D, it would roll towards M.

JAMES YULE.

THE PRISMATIC COMPASS.



Divide the given circle into 12 equal parts (see Hayter's Introduction); number each division, as in the drawing above.

With *Blue* (Prussian blue) colour from 1 to 7, and let it thoroughly dry;

With *Red* (carmine) colour from 5 to 11, and, when dry,

With *Yellow* (gamboge) colour from 9 to 3.

Blue..........	1	2	3	4	5	6	7
Red...........	5	6	7	8	9	10	11
Yellow.......	9	10	11	12	1	2	3
	Compound.	Mixed.	Compound.	PRIMITIVE.	Compound.	Mixed.	Compound.

Cold colours....	1	2	3	4	5	6
Warm colours.	7	8	9	10	11	12

Showing what colours are in *opposition* to each other.

Then with *Blue* colour, 3, 4, and 5.
Red colour, 7, 8, and 9.
Yellow colour, 11, 12, and 1.

These will give the compounds.

CÆSAR BORGIA.

EFFECTS OF FLY-WHEELS.

SIR,—Having, in the course of an extensive intercourse with operative mechanics, frequent occasion to observe that very incorrect notions are entertained with respect to the operation of Fly-Wheels, I have thought that an explanation of the manner of their operation might profitably occupy a space in your pages; and I have, therefore (in the hope that you will agree with me in thinking it worthy of insertion), abstracted from an excellent article on the subject by Dr. Brewster, in his "Appendix to Ferguson's Lectures," as much as seems to me necessary to place the whole subject in a simple and clear light before your readers. B. D

"A Fly, in mechanics, is a heavy wheel or cylinder which moves rapidly

upon its axis, and is applied to machines for the purpose of rendering uniform a desultory or reciprocating motion, arising either from the nature of the machinery, from an inequality in the resistance to be overcome, or from an irregular application of the impelling power. When the first mover is inanimate, as wind, water, and steam, an inequality of force obviously arises from a variation in the velocity of the wind, from an increase of water occasioned by sudden rains, or from an augmentation or diminution of the steam in the boiler, produced by a variation in the heat of the furnace; and, accordingly, various methods have been adopted for regulating the action of these variable powers. The same inequality of force obtains when machines are moved by horses or men. Every animal exerts its greatest strength when first set to work. After pulling for some time, its strength will be impaired; and when the resistance is great, it will take frequent, though short relaxation, and then commence its labour with renovated vigour. These intervals of rest and vigorous exertion must always produce a variation in the velocity of the machine, which ought particularly to be avoided, as being detrimental to the communicating parts as well as the performance of the machine, and injurious to the animal which is employed to drive it. But if a fly, consisting either of cross bars, or a massy circular rim, be connected with the machinery, all these inconveniences will be removed. As every fly-wheel must revolve with great rapidity, the momentum of its circumference must be very considerable, and will consequently resist every attempt either to accelerate or retard its motion. When the machine, therefore, has been put in motion, the fly-wheel will be whirling with an uniform celerity, and with a force capable of continuing that celerity when there is any relaxation in the impelling power. After a short rest, the animal renews his efforts, but the machine is now moving with its former velocity, and these fresh efforts will have a tendency to increase the velocity: the fly, however, now acts as a resisting power, receives the greatest part of the superfluous motion, and causes the machinery to preserve its original celerity. In this way the fly secures to the engine an uniform motion, whether the animal takes occasional relaxation, or exerts his force with redoubled ardour.

"In machines built upon a large scale, there is no necessity for the interposition of a fly, as the *inertia* of the machinery supplies its place, and resists every change of motion that may be generated by an unequal admission of the corn.

"A variation in the velocity of engines arises also from the nature of the machinery. Let us suppose that a weight of 1000 pounds is to be raised from the bottom of a well fifty feet deep, by means of a bucket attached to an iron chain which winds round a barrel or cylinder; and that every foot in length of this chain weighs two pounds: it is evident that the resistance to be overcome in the first moment is 1000 pounds, added to 50 pounds, the weight of the chain; and that this resistance diminishes gradually, as the chain coils round the cylinder, till it becomes only 1000 pounds, when the chain is completely wound up. The resistance therefore decreases from 1050 to 1000 pounds; and if the impelling power is inanimate, the velocity of the bucket will gradually increase; but if an animal is employed, it will generally proportion its action to the resisting load, and must therefore pull with a greater or less force, according as the bucket is near the bottom or top of the well. In this case, however, the assistance of a fly may be dispensed with, because the resistance diminishes uniformly, and may be rendered constant, by making the barrel conical, so that the chain may wind upon the part nearest the vertex at the commencement of the motion, the diameter of the barrel gradually increasing as the weight diminishes. In this way the variable resistance will be equalized much better than by the application of a fly-wheel; for the fly, having no power of its own, must necessarily waste the impelling power.

"When machinery is driven by a single stroke steam-engine, there is such an inequality in the impelling power, that, for two or three seconds, it does not act at all. During this interval of inactivity, the machinery would necessarily stop, were it not impelled by a massy fly-wheel of a great diameter, revolving with rapidity, till the moving power again resumes its energy.

"If the moving power is a man acting with a handle or winch, it is subject to great inequalities. The greatest force is exerted when the man pulls the handle upwards from the height of his knee, and he acts with the least force when the handle, being in a vertical position, is thrust from him in a horizontal direction. The force is again increased when the handle is pushed downwards by the man's weight, and it is diminished when the handle, being at its lowest point, is pulled towards him horizontally. But when a fly is properly connected with the machinery, these irregular exertions are equalized, the velocity becomes uniform, and the load is raised with an equable and steady motion.

"In many cases, where the impelling force is alternately augmented or diminished, the performance of the machine may be increased by rendering the resistance unequal, and accommodating it to the inequalities of the moving power.

Dr. Robison observes, that 'there are some beautiful specimens of this kind of adjustment in the mechanism of animal bodies.'

"Besides the utility of fly-wheels as regulators of machinery, they have been employed for accumulating or collecting power. If motion is communicated to a fly-wheel by means of a small force, and if this force is continued till the wheel has acquired a great velocity, such a quantity of motion will be accumulated in its circumference as to overcome resistances, and produce effects, which could never have been accomplished by the original force. So great is this accumulation of power, that a force equivalent to 20 pounds, applied for the space of 37 seconds to the circumference of a cylinder, 20 feet diameter, which weighs 4713 pounds, would, at the distance of one foot from the centre, give an impulse to a musket-ball equal to what it receives from a full charge of gunpowder. In the space of six minutes and ten seconds, the same effect would be produced, if the cylinder was driven by a man who constantly exerted a force of 20 pounds at a winch one foot long

"This accumulation of power is finely exemplified in the sling. When the thong which contains the stone is swung round the head of the slinger, the force of the hand is continually accumulating in the revolving stone, till it is discharged with a degree of rapidity which it would never have received from the force of the hand alone. When a stone is projected from the hand itself, there is even then a certain degree of force accumulated, though the stone only moves through the arch of a circle. If we fix the stone in an opening at the extremity of a piece of wood two feet long, and discharge it in the usual way, there will be more force accumulated than with the hand alone, for the stone describes a larger arch in the same time, and must therefore be projected with greater force.

"When coins or medals are struck, a very considerable accumulation of power is necessary, and this is effected by means of a fly. The force is first accumulated in weights fixed in the end of the fly; this force is communicated to two levers, by which it is farther condensed; and from these levers it is transmitted to a screw, by which it suffers a second condensation. The stamp is then impressed on the coin or medal by means of this force, which was first accumulated by the fly, and afterwards augmented by the intervention of two mechanical powers.

"Notwithstanding the great advantages of fly-wheels, both as regulators of machines and collectors of power, their utility wholly depends upon the position which is assigned them, relative to the impelled and working points of the engine. For this purpose no particular rules can be laid down, as their position depends altogether on the nature of the machinery. We may observe, however, in general, that when fly-wheels are employed to regulate machinery, they should be near the impelling power; and when used to accumulate force in the working point, they should not be far distant from it. In hand-mills for grinding corn, the fly is, for the most part, very injudiciously fixed on the axis to which the winch is attached; whereas it should always be fastened to the upper millstone, so as to revolve with the same rapidity. In the first position, indeed, it must equalize the varying efforts of the power which moves the winch; but when it is attached to the turning millstone, it not only does this, but contributes very effectually to the grinding of the corn.

"Dr. Desaguliers mentions an instance of a blundering engineer, who applied a fly-wheel to the slowest mover of the machine, instead of the swiftest. The machine was driven by four men, and when the fly was taken away, one man was sufficiently able to work it. The error of the workman arose from his conceiving, like many others, that the fly added power to the machine; but we presume that Dr. Desaguliers himself has been accessory to this general misconception of its nature, by denominating it a *mechanical power*. By the interposition of a fly, however, as the Doctor well knew, we gain no mechanical force; the impelling power, on the contrary, is wasted, and the fly itself even loses some of the force which it receives, by the resistance of the air."

EXTRACTING ROOTS OF PERFECT CUBE NUMBERS.

SIR,—I have read, with much pleasure, the many communications made to you, as replies to J. T.'s inquiry respecting the best method of Extracting the Cube Root. I have not time, at present, to say any thing on the scientific principles of the subject, but at some future time, perhaps, I may lay them before you, in a manner which will enable persons not accustomed to such calculations more easily to learn the manner of *extracting* the roots of cube numbers, on principles deduced from the peculiar nature of their formation.

Permit me now to lay before you two methods by which the roots of all perfect cube numbers may be

discovered by persons totally unacquainted with the regular proceedings used for *extracting* them.

The first results from the application of a very curious property possessed by the number 6, viz. if the cube numbers less than that of 6 be divided by 6, the remainders on the divisions will be the respective roots :—

$2^3 = 8$	$8 \div 6$	Quotient	1	Remainder 2
$3^3 = 27$	$27 \div 6$		4	3
$4^3 = 64$	$64 \div 6$		10	4
$5^3 = 125$	$125 \div 6$		20	5
$6^3 = 216$	$216 \div 6$		36	0
$7^3 = 343$	$343 \div 6$		57	1
$8^3 = 512$	$512 \div 6$		85	2
$9^3 = 729$	$729 \div 6$		121	3
$10^3 = 1000$	$1000 \div 6$		166	4
$11^3 = 1331$	$1331 \div 6$		221	5
$12^3 = 1728$	$1728 \div 6$		288	0
$13^3 = 2197$	$2197 \div 6$		366	1
$14^3 = 2744$	$2744 \div 6$		457	2

Now, from the above, we deduce the following method of discovering the root of any perfect cube number. Let a table be composed of the cubes of 6 and its multiples, of which the following will represent a portion, viz.—

$48^3 = 110{,}592$
$54^3 = 157{,}464$
$60^3 = 216{,}000$
$66^3 = 287{,}496$
$72^3 = 373{,}248$
$78^3 = 474{,}552$

Then let the cube number, 117,649 be proposed. On reference to our table, we find it is greater than the cube of 48, and less than that of 54: let it be divided by 6, viz. 19608, and 1 remainder, which shows at once that its root must be an unit greater than a multiple of 6; and as it is less than the cube of 54, it must be the cube of 48 + 1, and on calculation we find $49^3 = 117{,}649$. Let 175,616 be proposed; we find it is greater than the cube of 54, and less than that of 60; dividing by 6, we find the remainder 2, therefore it must be the cube of 54 + 2, and we accordingly find its root to be 56. Let 250,047 be proposed; it is greater than the cube of 60, and less than that of 66, and on being divided by 6, leaves, as the remainder, 3; $\therefore \sqrt[3]{250{,}047} = 63$. These few examples are sufficient to enable any person to apply this method in practice.

My other method is derived from a curious property in the cubes, which is this; no two digits terminate their cubes in the same digit :—

$1^3 = 1$	1^3 terminates in	1
$2^3 = 8$	8^3	2
$3^3 = 27$	7^3	3
$4^3 = 64$	4^3	4
$5^3 = 125$	5^3	5
$6^3 = 216$	6^3	6
$7^3 = 343$	3^3	7
$8^3 = 512$	2^3	8
$9^3 = 729$	9^3	9
$10^3 = 1000$	10^3	0

Hence, in any cube number, the terminating digit of the root is indicated by the terminating digit of the cube. Let [illegible] ow compose a table of the cubes o[illegible] [illegible]0 and its multiples, which will be easily done as far as

100, as it only requires the addition of 000 to the cube of each digit.

10^3	=	1,000
20^3	=	8,000
30^3	=	27,000
40^3	=	64,000
50^3	=	125,000
60^3	=	216,000
70^3	=	343,000
80^3	=	512,000
90^3	=	729,000
100^3	=	1,000,000

Let 148,877 be proposed, and its cube root required; we find, by inspecting the table, that it is greater than the cube of 50, and less than that of 60, and its terminating digit is 7; now, as on digit gives a cube terminating in 7, except 3, it is plain that the number proposed must be the cube of 50 + 3, and we find that $\sqrt[3]{148,887} = 53$; 614,125 is greater than the cube of 80, and less than that of 90; but its terminating digit, 5, shows its root must terminate in the same; $\therefore$ 85 is its cube root. I need not add any thing to this explanation.

When the cube of any number is multiplied by any factor, and the square of the same number also multiplied, and the number itself multiplied, the sum of the three products will form one side of what is called an adfected cubic equation, which is usually expressed as follows:

$$6x^3 + 8x^2 + 12x = 292,832,930.$$

It will be easily perceived that the extraction of the root, or the value of x, in such an equation, must present greater difficulties than the extraction of the root of a simple cube number, which may be expressed $x^3 = 1,000,000$.

Will you allow an untaught philosopher to attempt the extraction of the root of the adfected cubic equation, as first mentioned?

Let $6x^3 + 8x^2 + 12x = 292,832,930$

Quere x?

6	8	12	292,832,930	365
9	3	1,2		
		24,.		
		54,..		
		54,241,2	162,723,6..	3
1st divisor				
2700	66	,12	130,109,35.	
540		52,8 .		
·36		19,656...		
3276		19,70,892	118,253,52.	6
388800	725	12	11,855,810	
5400		5,800		
25		2,365,350		
394225		2,371,162	11,855,810	5
			00,000,000	
			. x =	365

I am, Sir, your most obedient servant,

Cork, Dec. 14th, 1824.

RICHARD DOWDEN.

HIGH PRICE OF BEER.

Sir,—As the true friend of the Mechanics, and, perhaps, the best they have, because you possess the means as well as the will to serve them, I take the liberty of addressing you to entreat you will upon another occasion step forward in their cause.

I see, by the Newspapers, that it is the intention of his Majesty's Ministers to apply the surplus revenue of the country in taking off certain taxes, which, in my opinion, might as well remain, or, at least, could better be borne by the parties paying them than the present enormous duty upon beer can be by the labouring man and the mechanic. It has again and again been demonstrated that beer is the most nutritious and wholesome beverage for the hard-working man, and that it is essential to his sustenance under fatigue or great exertion; and that spirits are, in an equal degree, injurious, and productive of the worst consequences, by stimulating men's minds to a state next to madness, and so fitting them for the commission of every species of crime; and the opinions of the best informed men have received confirmation by the last declarations of criminals themselves, that spirits have not only these effects, but have often been the exciting cause even to murder.

Now, Sir, the Chancellor of the Exchequer proposes to reduce the duties upon spiritous liquors (this *bane* of life), and to leave beer, that wholesome and necessary article, just where it was. But this is not all that I have to submit to your and the public's consideration. There is an inequality, and, consequently, an injustice in the taxation upon beer. That which the noblemen and the wealthy brew for their families and establishments pays no tax; whereas that which is brewed for sale is burthened with 10*s*. per barrel. This may comparatively and in theory bear a feasible sort of justification, inasmuch as many articles for private use are exempt from duties which those prepared for sale or merchandise are subjected to. But, Mr. Editor, let us look at it in practice. The wealthy man, with many servants, whose time can well be spared, and whose capacious cellars and ample conveniences admit of it, can brew, it is true, and feel no inconvenience. Can the mechanic or the citizen do this? Have they the means to purchase the malt, the hops, the utensils for brewing? Will their lodgings in town, or their cottages in the country, admit of it? Can their time be spared to brew in small quantities? In short, Mr. Editor, is it not wholly and absolutely out of the mechanic's and the labourer's power? and is he not, of necessity, *compelled* to purchase of the brewer or the publican, who must pay 10*s*. per barrel duty upon it *as beer*, over and above what the rich man pays in malt and hops? Is this fair?—is it just?—is it not oppressive? I would not willingly suffer my feelings to lead me into improper or disrespectful expressions. I am as loyal as any man living, and venerate the constituted authorities. I believe his Majesty's present Ministers are good men, and mean every thing for the best, and I esteem them. I cannot, however, altogether suppress my feelings upon a subject so at variance with the declared intentions of the Chancellor of the Exchequer, that he was desirous, as much as possible, to relieve the middling and lower classes of society in preference to the more opulent, *and so opposed to what I conceive to be just and right.*

To elucidate the inequality of the present duty upon beer, permit me to submit the following short statement:—

A quarter of malt pays 20*s*. duty; and this, according to the common calculation, will need 8 pounds of hops, which pay 2*d*. per pound duty, making 21*s*. 4*d*., from which it is generally calculated that 3 barrels of strong beer, of the quality of ale or porter, may be brewed. This makes the duty to private persons only 7*s*. $1\frac{1}{4}$*d*. per barrel, whereas the duty upon that which the mechanic and poor man drinks is 17*s*. $1\frac{1}{4}$*d*.; so that the mechanic, who, of *necessity, must purchase, because he cannot brew*, pays

for his beer more than double the duty which the rich man pays.

If the duty upon beer is of such amount and importance, in point of revenue, that it cannot, under the existing emergencies, be given up, let it be equalized. Place an equivalent additional duty on the malt and hops, *that all may pay alike;* or let the Government give up a portion of the duty upon beer. This latter mode would be very little (if any) loss to the revenue, because, if a portion of the duty were given up, the wealthy would purchase of the brewer rather than be at the trouble of brewing, and the consumption would be greater; and, consequently, the duty upon malt as well as upon beer would be increased, and the agriculturist, *that darling child of recent legislation*, would come in for a share of the advantages.

I really think, Mr. Editor, that if this matter be properly represented, it will receive that attention of which I am sure you will consider it deserving. I therefore entreat you to devote a portion of your valuable Magazine to the discussion of the subject, convinced that by doing so you will confer a lasting obligation upon every hardworking man, and for which, I trust, they will feel grateful. I can answer for one, who subscribes himself,

Your obliged servant
and well-wisher,
MARK ANVIL, *Blacksmith.*

Thames-street, 13th March, 1825.

SIR,—Allow an old Correspondent to intrude a few words, on a subject that militates not a little against the perfection of machinery in general, and is a heavy accumulation of friction in the operation of every species of workmen. You will no doubt agree with all judges of mechanism, that the most complete system of machinery becomes injured when not supplied with oil, and that muscular energy requires, in like manner, to be recruited continually. Now, Sir, how can it be supposed the workman can act with energy, and execute with judgment, if his own machine be debilitated, from want of that proper sustenance which is necessary to lubricate the frame, invigorate the mind, and give strength and energy to those members which are incessantly employed in promoting the general good? Surely the selfish, which is the social principle in every man's breast, requires no forced excitement, even with those whose circumstances place them above labouring for their own support, to feel commiseration for the working classes, whose hands, with all their industry, may be said to be unable to feed their mouths. "Man is not to live by bread alone," is the language of Divinity and Nature. But how, under the existing duties on beer, is a man to support his perpetually exhausting frame, and find bread for his family, out of his limited wages? The mechanics of England are the glory, strength, and riches of the land. Deprived of these, where is our army, fleet, or even country? As, Sir, a word to the wise is sufficient, and as the present Ministry are seriously bent on promoting the public weal, allow me the opportunity of stating, through the medium of your very popular Magazine, what I conceive would be productive of much benefit to the working classes, and of course to the revenue—that is, to the country at large. Bread is certainly the first of all considerations, and the late convictions for false returns of sales of flour, will doubtless come under legislative consideration; but the article *malt liquor*, which is almost the main stay of the labouring man's exertion, is a grievance, as the price of it now is, which presses most cruelly on those least able to bear it. Were the duty taken from the beer, the rich, who brew for themselves now, would buy of the brewer; by which an increased sale would follow, to the improvement of the revenue, and reduction of price to the mechanic. This necessary of life might be lower considerably in price, but for the enormous excise duty of ten shillings per barrel on beer, which, with those on malt and hops, amounting altogether to 17s. 1½d. on the barrel alone, the hardworking, meritorious mechanic is obliged to pay, in order to keep soul and body together, and give his family their daily bread. Surely a BRITISH SENATE will not permit such a state of things longer to remain.

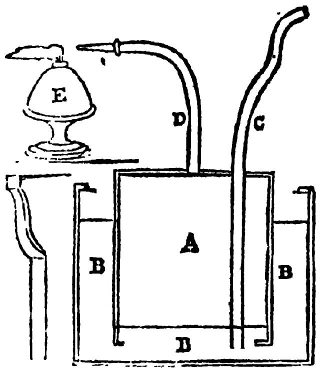
A STEAM ENGINE WORKMAN.

MR. SPEER'S CHUCK.

SIR,—The Members of the Society of Arts are certainly very ignorant (with reverence be it spoken) of the tools that are used in an engineer's workshop. The Chuck, said, in your last Number, to be invented by E. Speer, Esq., is as common as chairs in a barber's shop.

J. Y.

SIMPLE BLOWPIPE.



SIR,—Having seen in your Magazine the sketch of a Steam-Soldering Apparatus, from a Young Goldsmith, the foregoing plan came to my mind. Whether new or old, I know not; if new, and you should consider it worthy of a place in your valuable little work, I shall feel a pride in having submitted something, however small and insignificant, for the good of my brother mechanics. I once saw an apparatus used in glass-working, which I conceived to be the same, but I could not see the acting part. There are similar constructions, on a much larger scale, used at some iron-foundries, to keep up a regular blast. The description is simple :—

A is a vessel, open at bottom, fixed in BBB (which is open at top), by stays at the sides or bottom, in such a manner as to have a free communication from one to the other. C, a mouth-pipe, by which the operator fills the vessel, A with air. D, a pipe, to convey the blast to a lamp, E; the part BBB represents water, which just covers the end of the pipe, C, and prevents any air from escaping, except by the pipe, D. When the vessel is filled with air, there will be a great pressure of water, which will, I think, produce a strong blast, through a small aperture. The apparatus may be so arranged that the lamp may stand on a bench or table, and the pipes bent to correspond, so that the operator may, as he goes on with his work, renew the air from time to time.

I am, Sir,

Your obedient servant,

D. S. W.

A Mathematical Instrument-maker.

March 25th, 1825.

NOTICE TO OUR READERS AND CORRESPONDENTS.

The present Number concludes our Third Volume. On the 30th of April next, we shall publish a Supplement to the Volume, containing Title, Preface, Index, &c. with a Portrait, by an eminent Engraver, of that enlightened and indefatigable Friend of the Working Classes, HENRY BROUGHAM, *Esq. M.P.*

N. D.—No; unless before the 15th of April.

*** Notices to other Correspondents in our next Number.

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